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In Past 26 Years

Oil Responsible For Development Of California

By Arthur Richard Hinton

California's modern development is the history of its oil and gas, worth more than all the gold mined since 1849. For nearly 35 years their annual value in crude form alone, to say nothing of manufactured products, has ranged from 70% to 85% of the total value of all the state's minerals combined. Natural gas utilized comes 99% from oil wells; huge dry gas reserves are being developed and blocked for future use by oil capital using oil well drilling equipment, and employing oilfield workmen.

Once Australian coal at $10 per ton blocked California development. During the 90's the Santa Fe adopted oil as its California locomotive fuel. Following this success, oil soon drove coal from the state, later from the entire Pacific Coast. National and worldwide results also followed the Santa Fe's move, entire credit for which is due to two men, both now dead, K. C. Wade, general manager, and his assistant, Fred B. Henderson, later a high official of the Associated Oil Co.

Others have told the history of the California oil fields. This article will deal with California oil-gas development and its effects along broader lines.

Outstanding developments of oil, leading problems which it has faced, solved and conquered in its onward rush, with few exceptions, fall under the following heads:

(1) Discovery, development; (2) overproduction; (3) extension of markets; (4) public relations; (5) finances; (6) mechanical equipment; (7) manufacturing, refining; (8) transportation, distribution, sales; (9) labor.

Discoveries of Oil

Seepages, outcrops, field-learned elementary geology, guided practical oil men to California's first oil discoveries. Often good practical geologists themselves, they frequently were wont to disparage more advanced scientific studies. Today we know that more advanced geology can figure possibilities of oil from things less obvious than seepages and outcrops, and has been responsible for many important discoveries, which otherwise might yet be uknown, despite some unwillingness to give the scientist due credit. Such knowledge has grown enormously during the last two decades in the oil fields, due not only to successful but also to unsuccessful drilling. Scientific study of dry holes, of their formations, and of every stratum through which they passed, has enriched the fund of information by which we can judge in future where to drill and where not to drill. Study of a dry wildcat, analysis of cores, accurate correlations, have often told, as nothing else could, where to try again and thus have been the means of opening more than one great oil field.

During the 1920's, California and other oil regions witnessed an intensification of the search for oil. Big capital entered the race, the large oil companies in the lead. Their geologists became scouts looking for places to drill. Executives with plenty of present production rejected proved properties and drilled remote spots. Geologists did not fear the results of recommending a site that might be dry, for the companies were looking ahead, seeking future reserves, spending millions to find them, to do which they were ready to test geological theories that had any substantial basis and to write off the loss if they were disproved by the drill, considering the knowledge gained ample compensation.

Unwittingly Uncle Sam did much to promote these wildcat operations. Taxes he imposed forbade companies to retain excess earnings as reserves or to pay them to stockholders as dividends, hence they were spent with lavish hands.

Aviation gave the geologist his chance to study the earth in a way never vouched him when standing upon its surface. California's surface area lends itself readily to air mapping. Thick forests and tropical jungles do not exist where its oil is found, the land lies generally fairly open to view from above. By now its actual and potential fields have been mapped from the sky, work which once done is permanent and of inestimable benefit.

Core drilling and geophysics have come to the aid of the geologist. After all, he can see no further beneath the surface than you or I, and this is just what the core drill and geophysical equipment enable him to do. The core drill now follows and accompanies the geologist in wildcat areas, putting down small diameter holes from just below grass roots to 2000 ft. or a little further down, bringing up samples of the formation for analysis, study and correlation at small cost, thus avoiding the huge expense of drilling with heavy oil-well equipment only to find perhaps a hopeless formation. Geophysics finds out about subsurface formations from the surface. Wonderfully successful in the Texas-Louisiana Gulf Coast salt dome areas, geophysics is being adapted to California conditions by trial and study and now shows signs of becoming a great factor in the future development of the state's oil and gas.

Over-Production Brings Markets

California market expansion has come from over-production, which soon arrived, just as it has in every other region, the resulting low prices, and the necessity of disposing of surplus which has driven the marketing companies to go far afield to seek new outlets. Standard Oil Co. used California kerosene produced cheaply from surplus crude to supply the huge Chinese market it had built up during the earlier days of Appalachian over-production. Union Oil pioneered the Pacific Northwest fuel market when its alliance with the Independent Oil Producers Agency assured ample supplies of fuel oil. Other marketing companies came in immediately. Oil displaced coal as fuel for Oregon, Washington and British Columbia railroads, for coastwise, Columbia River and Puget Sound shipping, for electric generation, factories, hotels, public buildings, and apartments, and as material for manufacture of gas. Likewise 25 years ago, huge supplies sent Union salesmen to South America and made oil the sole fuel for Chilean railroads, nitrate works, electric plants, factories, hotels and public buildings, and of the Panama Canal builders.

This year California's accumulation of more than 160,000,000 bbls. of fuel oil has captured the Atlantic Coast market since the tariff stopped South American imports. Long a heavy burden and expense, these stores are finding outlets that should be of great future value. World business revival will call for more oil, and our storage will be further drained.

California asphalt, its manufacture pushed by over-production, has built miles of streets everywhere west of the Rockies and some on the Atlantic Coast, in Tokio, Yokohoma, Hong Kong, Shanghai, the cities of Australia and other parts of the world. Overflowing reservoirs of heavy crude have been emptied by selling their contents for road oil, thus creating future markets.

In 1908, Congressman Needham asked tariff protection against South American asphalt. We still have none, but its need has been replaced by the need for protection against Mexican-South American imports of heavy crude used to make as-

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phalt in Atlantic Coast refineries to compete with California's product.

Public Relations, Politics

Public relations of the oil industry have changed since the days of Rockefeller, Rogers, Flagler and Archibold, where they scarcely were recognized as existing at all. Such a policy may have had advantages then, but it made possible Ida M. Tarbell's success and led to consequences which forced its abandonment. Now all leading companies, the A. P. I. and various oil organizations, maintain public relations departments. Data which they furnish the press may have helped to improve relations. They have probably aided the fight against excessive taxation, at least to the extent of making it less excessive than otherwise it might be. However, these departments leave much to be desired even as purveyers of oil information to the public, as was shown at the first Washington conferences which led to adoption of the oil code and the establishment of federal oil control. On these vitally important occasions, the publicity departments failed to function and those who opposed what the A. P. I. and the leading companies sought, seized the front pages for their propaganda.

Several times this writer has pointed out in these columns that present public relations departments are only one-way establishments. They tell the public about the industry, but they are not organized to find out what the public thinks and desires and not authorized to tell the directors of the companies what they may learn. There is vital need for public relations departments that will do these things and in order to do so they should be headed by high class men who should be directors of their companies, able to meet the other directors as equals and colleagues, not as servants no matter how highly placed. Whenever the leaders of the industry do this there will be fewer blunders in dealing with the people, legislatres and state commissions.

Litigation, Legislation

Political attacks, oppressive legislation and harassing litigation have long plagued the oil industry. California state politics and legislation have shown no hostility. Legislation touching the oil business has been enacted only at the request or at least with the concurrence of the industry or a large section thereof. One exception may be cited in the gasoline tax, but the amount imposed is small compared with that in many other states. Only once, when the referendum was taken on legislation for self-government of the industry, have oil affairs become a political issue at the California polls. Only once has the state instituted hostile litigation against any part of the oil industry: the action taken to halt slant drilling to tap the tidelands at Huntington Beach, and this move had great support within the industry itself. It was early settled by friendly compromise. Legislatively and judicially California's attitude towards oil has been friendly and constructive. Here some may protest that the gas conservation law is a marked exception to the above statement. We will not oppose this contention. We incline to agree.

Outstanding examples of legislative cooperation with the industry are: (1) Establishment of the State Division of Oil & Gas to protect the oil strata from water infiltration by requiring the observance of proper casing programs in drilling; (2) modification of the Cartwright anti-trust law to legalize the cooperative marketing plans of the Independent Oil Producers Agency. Both the authorization of the leasing of tidelands for oil drilling and the repeal of the same when conditions changed were supported by the industry generally.

Dissolution of the old Standard Oil trust by the U. S. Supreme Court in 1911 emancipated California from eastern overlordship by throwing Standard of California, the greatest company in the state, entirely upon its own resources, and under control of its own directors in San Francisco. Aggressive expansion and sales campaigns to push California oil products followed. Our lubricants, previously neglected and condemned as inferior, were the immediate objects of this campaign. New processes were devised for their manufacture with highly successful results. These moves came just when the automobile's popularization was quadrupling Pacific Coast demand for lubrication, and enabled the home product to seize and hold nearly all the new trade.

Judicial enunciation of the "rule of reason" in anti-trust law enforcement in the Standard Oil case has been marked benefit to oil as well as to other industries, notwithstanding the policy of federal and state authorities' frequently to ignore its plain meaning and to interpret it as illiberally as possible.

Federal Oil Land Policy Changed

Revolutionary changes of policy in the relations between the government and a large section of the producers of oil ended the 10-year tie-up of federal oil lands by the Taft withdrawal orders of Sept. 27, 1909. Prior to that time, the law provided no method for acquiring title to federal owned prospective oil lands. Judicial and administrative interpretations had stretched the Placer Mining Act to cover them, but it was extremely unsatisfactory because the placer law had been drawn to fit the reverse of the oil man's problem. It required a discovery before any title could be acquired or even exclusive temporary possession given. All right for the placer locator who found what he sought quickly and on the surface; all wrong for the oil man who had first to drill an expensive hole. Claim jumping was greatly encouraged and the early fields were the scene of armed clashes and any man expert with a gun, willing to use it and take risks, found ready employment to guard claims.

Congressman Smith in 1908 introduced a bill to guarantee oil seekers peaceful possession of recorded claims for a period sufficient to drill wells and prove or disprove the lands. Full patent was to be issued upon discovery. Its enactment would have solved the difficulties raised under the placer act, would have given the oil developer fee titles, eliminated the government's control over the land and its development, and left official Washington without power to intervene in oil affairs in the capacity of a landlord. But it was not to be.

Gifford Pinchot's conservation of resources movement was sweeping the country; naturally, its upholders raised an alarming cry that oil was being wasted and would soon be all gone.

The U. S. Geological Survey conducted an inquiry as to known oil deposits, rates of production, consumption and expected future demands. A highly alarming report was submitted to President Taft, showing an almost immediately pending shortage, recommending that all government oil land be withdrawn from entry, and that legislation be enacted by which permanent title would be retained by the nation and only leases given operators. On Sept. 27, 1909, he withdrew all such acreage from entry.

What followed these withdrawals and their immediate effect upon oil operations will not be repeated. The end came with the enactment of the mineral leasing law of 1920, still in effect with some amendments. Under its provisions, the Hoover Administration was able to halt prospecting upon public lands, to force Kettleman operators to agree to curtailment and to accept unit plans of operation. Legislation has been enacted to reinforce these powers, but the foundation of everything done under Secretaries Wilbur and Ickes has been the leasing policy definitely inaugurated in 1920.

Public relations covers all the above matters of legislation, litigation and national or state administration. This writer believes that they will continue to constitute a department of affairs of constantly growing importance to the oil, as well as to all other industries, and that the keeping of a hand on the pulse of public opinion, the maintenance of close contact with many public organizations seeking to cotrol affairs, with statesmen, political leaders, legislators, national and state administrators, will be most vital.

Finances—Oil and Banks

Early in oil history, drilling to depths calling for expenditures beyond the capacity of most individual purses became necessary and corporations had to take over the work. Spectacular discoveries led the public to pour money into development with a lavish hand, people risking their life savings, mortgaging their homes, selling properties, liquidating safe investments for highly speculative ventures into unknown realms. Naturally, such conditions have been a paradise for dishonest promoters and incompetent and sometimes dishonest managers with the result that investments were wiped out, sometimes when good returns ought to have been obtained, and state regulations of financing were demanded. Efforts in this last direction have accomplished some good, but have also often served to handicap legitimate business and may have to be modified when more development is needed and money must be raised.

Bankers entrusted with other people's money must be conservative and naturally they decline to put funds in speculative oil ventures. Such conservatism, however, is no excuse for the attitude many bankers have taken, and continue to take, towards every development of oil even in communities whose prosperity, even life depends largely upon oil. Pleading that they are unable to discriminate between sound investments in going oil companies and speculation, as some do, is close to a confession of incompetence. Recent years have witnessed some marked improvement in banking circles as to substantial oil investments. Even so, money for new development must be sought largely among individuals.

During the last decade there has been a strong tendency to resort to the sale of units, land leases, percentages, and royalties rather than of stock for financing wildcat development.

Mechanical Problems—The Rotary

California's first rotary came from

Texas in 1908, and found an immediate customer in the Amalgamated Oil Co., subsidiary of Associated, drilling in the old Salt Lake field west of Los Angeles. Prior to that date all California drilling was done by cable tools, exceedingly slow in action but reasonably satisfactory down to about 2000 ft. The Texas rotary met with instant success. Oldtime "doubting Thomases" who saw it in action, often still maintaining that it would never work in some fields, had to admit that where "it could handle the formation at all its speed make the cable look pretty sick". Before the end of 1908, Amalgamated had dotted its Salt Lake leases with rotaries, Standard had several at work in Midway, Union was trying them out at Santa Maria, others were ordering them for earliest possible delivery, and California supply house were selling rotaries more and more, cable tools less and less.

Development of the modern core barrel removed a leading obstacle to the use of the rotary in other than proved fields where it mudded off formations and a rotary-drilled wildcat might pass through oil strata without its being discovered. Other improvements removed the early need for changing to the cable before drilling into the oil sand to complete the well.

In 1924, Alexander Anderson's invention of methods of underground surveying by which the well's direction and degree of deviation from the vertical could be accurately determined removed the last hazard of rotary drilling which had caused the loss of wells, the bottom of which might be almost anywhere except under the derrick, a state of affairs which made correlation of formations impossible ,and the gathering of accurate geological and engineering data often out of the question. Surveying, now a highly perfected art following several different systems, has solved the problem of knowing where a hole is drifting; redrilling and the whipstock straighten it.

Within the past three years another Californian, H. John Eastman, has devised a highly successful directional drilling method, by which a well may be completed at a desired point quite remote from the derrick site. Its varied possibilities have been demonstrated by its employment to tap a blazing West Texas well, relieve the pressure and make possible the extinguishing of the flames.

California-Built Equipment

While California's first rotaries came from Texas, experience soon demonstrated the need for heavier and stronger equipment to handle California formations and deep drilling. California's first equipment all came from the East, from Pittsburgh, Toledo and other manufacturing centers. More and more, however, home capital has gone into the business, erected plants around Los Angeles and is now building equipment that has gone abroad to other oil states and into many foreign countries,—Mexico, South America, Russia. Union Tool Co., now owned by the National Supply Co. was a pioneer in this development; Wilson & Willard Manufacturing Co. was another early fabricator of drilling equipment. Emsco, California Equipment, Shaffer, Doheny-Stone drill, and a long list of others have come into the picture.

Early derricks were of wood, but steel now has the upper hand. Derricks today are taller, more strongly built and braced, both a result of and a contributor to modern deep drilling.

Thirty years ago, the large percentage of wells was less than 1500 ft. in depth, 2000 ft. was considered a fairly deep well, 3000 was deep, 4000 was a startling accomplishment. Deeper drilling came about gradually. Salt Lake had some 4000 and 4500 ft. holes. Santa Maria was a pioneer in deep drilling. Today such wells are considered comparatively shallow, a deep well being one of 6000 to 8500 ft., with a number reaching 9000. The McAdams well, Kettleman North Dome, is just short of 11,000 ft. and General Petroleum's Berry No. 1, Belridge, is 11,377 ft. deep. These depths have been reached with ordinary California equipment.

Year by year as wells have gone deeper, equipment has become more elaborate, scientific and complicated, and the need for highly trained engineers in the oil fields has increased. Once the entire job was left in the hands of the drillers, men whose sole training was what they had learned in the derricks, but that day has passed. Petroleum engineers, trained in universities, now are employed everywhere oil is developed. California's schools and its field problems have produced hosts of the best who are found not alone in the state's own fields but in other states and abroad.

Manufacturing, Refining

California has been the home of big refining improvements and inventions. The world famous Dubbs cracking process, the basic patent for all cracking, was devised by the late J. A. Dubbs of Los Angeles and was worked out by him in an experimental plant on the Rice Ranch property at Santa Maria. M. J. Trumble's continuous distillation process was perfected in the Fullerton field and sold to Shell for $1,000,000. The late Dr. E. A. Starke, then with Standard, devised the method by which California lubricants were first made a success.

But for unavoidable delays in getting materials, Union Oil would now have in operation a newly perfected method of producing a variety of California lubricants possessed of all the better qualities of Eastern and Mid-Continent paraffin base oils.

California gasoline has achieved a nationwide reputation because of its antiknock qualities. Despite the output of eastern refineries, 4,462,819 bbls. of California motor fuel reached the Atlantic Coast during the first six months of 1934. This state is the big source of national fuel oil supply. Tankers moved 10,101,330 bbls. to the Atlantic Coast during the first six months this year. Foreigners, too, want both our gasoline and fuel oil. During the same period we shipped 4,078,078 bbls. of gasoline to Pacific foreign ports,—Japan, China, Australia, New Zealand, and the Latin American Pacific Coast; 497,749 bbls. to Atlantic foreign ports—Europe, Caribbean Sea ports, and the Atlantic Coast of South America. During the same period we exported 10,786,890 bbls. of fuel oil to Pacific foreign ports, by far the greater part to Japan; and 1,276,595 to Atlantic foreign ports, which includes several shipments as far as Montevideo, Uruguay.

Our total shipments by sea-going tankers for the first half of 1934 to all parts of the world, outside of the three Pacific Coast states, amounted to 40,253,583 bbls.

California has 42 refineries, with an aggregate daily capacity of 751,935 bbls., equal to 21.35% of the national total reported by the U. S. Bureau of Mines. Standard's refineries at Richmond and El Segundo each have 100,000 bbls. daily capacity, and its Bakersfield plant 25,000 bbls. With one or two exceptions, Richmond and El Segundo are the largest refineries in the United States. Union Oil operates two large refineries, one at Oleum, 17,000 bbls. capacity, now making lubricants chiefly, the other at Wilmington, capacity 51,000 bbls. Shell has two, one at Martinez, one at Wilmington. Other large California refineries are: Associated, Avon; Richfield, Hynes and Wilmington; The Texas Co., Wilmington. Thirty-odd smaller refineries are operated by different companies, mostly in the Los Angeles Basin, but some in San Joaquin Valley and at Ventura. Gasoline produced by these smaller refineries constituted a most important factor in the markets, most of it being of high quality.

Transportation, Distribution, Sales

Pipe line, tank car, tanker and barge, truck and trailer constitute the means of transportation of California oil. The first two are costly, only suited for movements on a big scale, hence their use is confined chiefly to larger units. Truck and trailer have proved useful, and have all but saved the existence of the smaller refiner and marketer.

California's first pipe line was a small one connecting Newhall and the Ventura county pipe lines with tidewater. Until about 1902, this pioneer line, one built by Capt. Matson from Coalinga to Monterey, and a number of short local lines connecting the then limited group of Los Angeles Basin fields with the city of Los Angeles, made up the entire pipe line system of the state. During 1903, Standard completed its line between the Kern county fields and the Richmond refinery. Associated and Southern Pacific soon after built a joint line from Bakersfield to San Francisco Bay, then Shell built one from Coalinga to Martinez, Union one from the Valley fields to the Coast in San Luis Obispo county, then General Petroleum and later Pan American (now Richfield) connected the San Joaquin Valley by pipe line. Since 1922, the Los Angeles Basin has been covered with a network of pipe lines. During the last few years other lines have been built from Kettleman North Dome to tidewater at Port San Luis, and Standard is at present connecting the entire San Joaquin Valley with Port San Luis. Exclusive of natural gas lines, California has not less than 2500 miles of pipe lines.

Excessive competition and cutthroat prices have characterized sales operation in the Los Angeles Basin and at times in the San Francisco Bay region and San Joaquin Valley. Endless efforts have been made to remedy this difficulty, most of which never accomplished anything, and one move which met with considerable success was declared illegal by the Department of Justice and ended by court injunction.

Relief has come through a marketing agreement signed by all refining companies but one, and approved by the U. S. Attorney General and Oil Administrator Ickes, by which prices are not to be cut in order that one may take business away from another, certain ethical rules are laid out and enforced, and an agency has been established to buy excess gasoline from smaller refiners, thus preventing its being dumped on the market at ruinous

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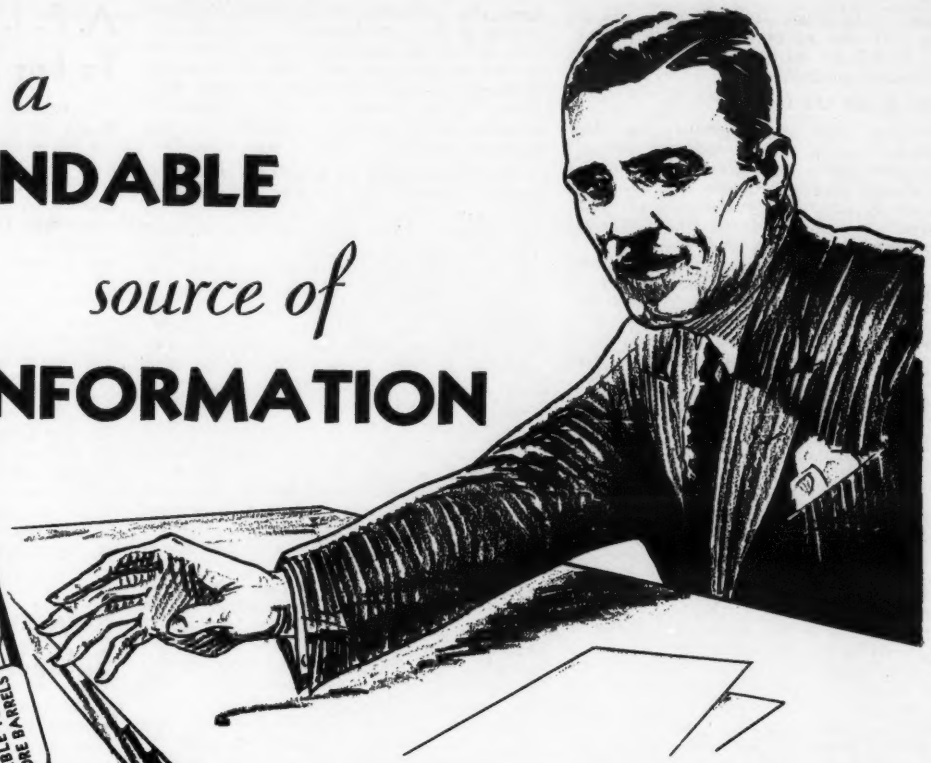

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figures. The whole is based upon the oil code. If this agreement proves permanent, it will go far to justify the temporary federal control.

Labor in the Oil Industry

Despite the long 12-hour day and seven-day week, the oil industry has always attracted a high grade of labor. It has always involved danger and has been classed by insurance companies as "hazardous," it has called for high physical standards of strength and endurance, it has often involved hard living conditions in places remote from large centers of population and comfort. Yet it has displayed a strong fascination for the type fo men needed in its ranks and sons have followed the footsteps of their fathers to the derricks and refineries.

Down to about 1918, oil field and refinery labor had remained unorganized. In that year, organization was started and was successful as regards a large part of the industry, and in 1921 there occurred the only strike in oil history up to this year. Organization on a national scale never met success until the NRA expressly upheld collective bargaining. Membership has since expanded enormously, and several local strikes have occurred in the Mid-Continent. To date, there have been no signs of trouble in California and none is expected.

Years ago, California abolished the 12-hour tour in fields, refineries, offices, and on pipe lines, while other states generally retain the 12-hour plan. One day off in seven has been the California rule over a long period, as against a full seven days' work elsewhere. State legislation has also been favorable to labor in the matter of compensation for injuries and death, and the use of safety appliances is required to an extent unknown in other states.

California companies have found the eight-hour day and release of men from seven-day toil made possible by employment of relief crews quite satisfactory. More work has been accomplished. Shorter hours have not reduced wages; on the contrary they have advanced since eight hours became the rule.

Introduction of the rotary, requiring the employment of five men on a tour instead of the two needed to operate cable tools, three tours instead of two, employment of relief crews to give men one day off in seven, all combined with the huge increase in drilling to raise the number of oil workers in prosperous times to figures which have added greatly to the industry's value to the state. Such great numbers have also tended to increase the problem of unemployment when the industry has had to slow down.

What Does the Future Offer?

The oil industry has met and solved every problem as it arose. Unless handicapped by outside interference, the industry will solve every future difficulty as it arises, sometimes quickly and easily, sometimes in long and bitter travail and at heavy cost. With all that is implied by what has just been said, however, this writer is convinced that the industry can solve its problems itself far better than can any Washington bureaucracy or any form of political overlordship or "brain trust". Present federal control, on its temporary basis, has accomplished obvious good, and some of its provisions may survive and guide the industry in the future. However, any attempt to make permanent the present control, with the Secretary of the Interior and an administrative board chosen from outside the industry as dictators, will lead to disaster. Nothing is more important than that Secretary Ickes' threats to revive the revolutionary Thomas Bill be blocked. Its enactment would be fatal.

While accepting as a temporary emergency measure the present federal control, recognizing that many men high in the industry differ with him, and perhaps that they are wiser than he, this writer has never been able to get up any enthusiasm over other than a minimum of legal control whether of state or nation. Meanwhile, the oil industry is undoubtedly reviving. National consumption of gasoline is 10% greater this year than last year, and revival of the motor car industry is evidence that the outlook is much brighter.

Yet there will be something different to reckon with in the future. Down to the present, the United States has been the world's greatest producer of oil, its output being about 70% of the world's, and its exports to all parts of the world enormous. Everything points to big changes here, to the fact that production of oil abroad is just in its infancy. South America is still coming up. Russia is coming back, but whether the Soviet country will be a serious international factor or be obliged to use up its production at home remains to be seen. However, the Iraq pipe line has just been completed and its competition must be quickly felt in Europe, especially as several governments are directly or indirectly interested in the oil to be brought from Mesopotamia.

Evidence seems fairly conclusive that only unexpectedly great enhancements of consumption abroad can prevent heavy permanent loss of export business as compared with pre-depression years, although we may expect some increase over the present and immediate past. Not only must we face this problem of sharp competition with foreign oil abroad, but we must recognize the fact that only the exclusion of foreign oil and all its products by high tariff or embargo, not to be changed for bargaining purposes for other commodities, will save the home markets for American producers, refiners, and workers who are towers of strength to the country, who pay astonishingly high percentages of its taxes and who furnish the sinews of peace and war. Considering the value of the American oil industry to the nation, and the taxes it pays, import duties of $1 per barrel on all foreign oil imports, to be raised whenever necessary, for the avowed purpose of absolute exclusion should be the rule.

Admission of foreign oil to our shores will not give us entry to the foreign markets, nor would such entry, if given, repay us for the loss of a fraction of our home market, by far the greatest in the world. Nothing could possibly build up foreign competition faster or more effectively than to allow oil from abroad to be sold here and to capture any share of our markets. Already it may be noted that Europe is increasing its manufacture of oil field supplies for use in Russia, South America, Iraq, and Persia where it will eventually drive out American products. Europeans will drive American skilled labor from foreign fields.

A. P. I. Invited To Los Angeles

A resolution to invite the officers, the board of directors, and the members of the American Petroleum Institute to hold the 1935 annual meeting of the Institute in Los Angeles was adopted Wednesday by the board of directors of the California Oil and Gas Association. Acceptance of the invitation was urged on the grounds that an important segment of the official personnel and the membership lives in California, that eight years have passed since an annual Institute meeting was held here, and that the California fields, which supply nearly 20 per cent of the total crude production of the United States, are worthy the close study of the entire industry, since California, with its deep-lying producing sands, has long been considered a proving ground for new equipment and methods. Civic officials and civic bodies of Los Angeles have expressed a willingness to join with the Association in extending the invitation.

Royalty Brokers Not Subject To Commission

California royalty brokers will not have to deal with the Federal Trade Commission unless they handle royalties from outside the state, according to the understanding here. The same rule applies to brokers in other states. California brokers will be subject to the State Corporation Commissioner whose rules are strict and require complete reports on properties, engineering data and titles passed upon by attorneys.

When royalties which are subject to federal jurisdiction are sold, under a new ruling just made by the Federal Trade Commission, the seller must file their list with required data only after the sale, thus permitting business to go on without delay. After-sales reports may seem like "locking the barn door after the horse is stolen" perhaps, but the view taken here is that the Commission is seeking to give proper latitude to business and at the same time to get complete information on what is being sold with a view to possible recommendations for future legislation.

Hewitt-Kuster Opens Office

The Hewitt-Kuster Co. has opened a branch office in Houston, Tex. The new office is at 4820 San Jacinto St., will be under the management of K. E. Lloyd, and will maintain an exclusive single shot rental service for the Texas and Louisiana areas. A new supply of the field computation chart for calculating the horizontal deviation and vertical depth of hole, without trigonometrical reference, has been made up and may again be obtained at the Long Beach office.

Edison Plan Approved

Secretary Ickes has approved a plan of orderly development for the Edison structure, Kern county, under which one well will be allowed for each 10 acres.

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Some Effects of Curtailment On Recovery Of Wells

By R. E. Allen

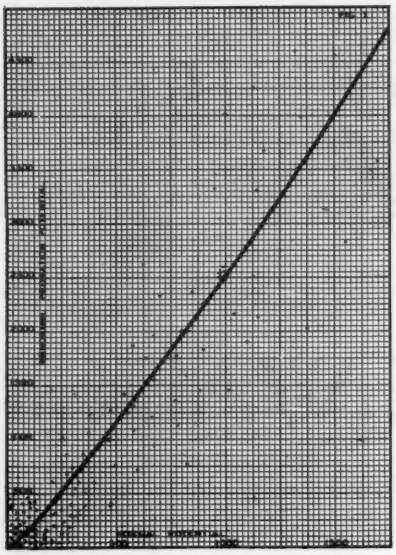


Figure I

There was once a time when a practical oil man would appraise or buy a producing property on the basis of from $200 to $500 per barrel of average daily settled production. Curtailment has, for the present at least, caused a virtual abandonment of the "barrel of settled production" as a yardstick of oil property value and in its place has come the "barrel of allowable production," which while an artificial thing, is nevertheless now the principal factor governing the rate of "payout" or investment return.

The potential production of a well, settled or otherwise, is of less importance in determining the present worth of a well than is the rate at which it may be produced. Speaking only of true potential for the moment, it is obvious that of two similar wells having the same potential, the one having the highest rate of allowable production would be worth proportionately more than the one of lesser allowable. The discount factor for deferred return and risk can easily vary the present values of the two wells by as much as 20% when allowable rates are not greatly different.

This fact has been largely responsible for the clamor from producers that similar wells receive similar allotments, a demand that has been largely met by the action of the Central Committee for July, 1934, when for the first time a uniform method of allocation was applied to all the fields of the state. It has also led to suggestions from some producers, particularly those with smaller wells, that the same percentage rate of return of the present value of each well be a controlling factor in the allocation of production.

The graduated method of determining pool quotas has this effect for it definitely retards the rate of income return as the wells increase in size.

Another reason why potential cannot be used as a satisfactory basis of value is the fact that there are potentials and potentials. One operator offering a well for sale may declaim about what the well did in one day while the operator considering purchase has in mind the amount of oil actually produced and sold in **one month** or **one year** and the equally important matter of how much the well declined while producing that amount of oil, for the decline-depletion ratio offers him the safest indication of what ultimate production may be expected and of what the allowable rate of production may be.

It is indeed unfortunate the producers themselves have such a wide range of ideas on the subject of potential for the confusion thus resulting manifests itself in controversies between operators in the same field and between operating groups in different fields. Every operator knows that the potential of a well depends, within certain limits, upon the length of the test and the mechanical conditions during the test. The range of these limits increases rapidly with the size of well, however, and it was this observed possible and comomn disparity between the true potentials and the proration potentials of large wells that led to first adoption of the graduated or power factor method as a method of correcting potentials to a more nearly relative basis. The later adoption of the same procedure as a method of production allocation was somewhat of a departure from its original

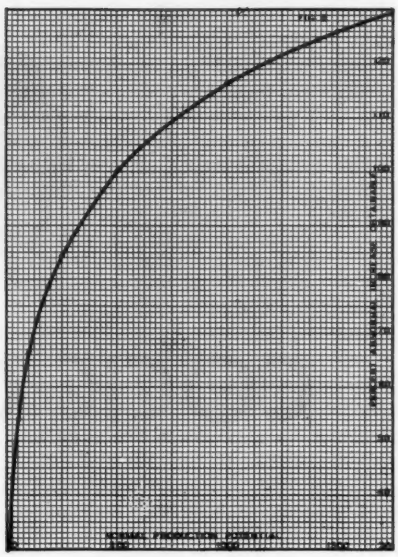


Figure II

purpose and was done for economic rather than physical reasons, it being considered that curtailment was in effect a type of income taxation or restriction and that accordingly graduated income tax principles should apply. A trend away from this principle is indicated by the

(Continued on Page 56)

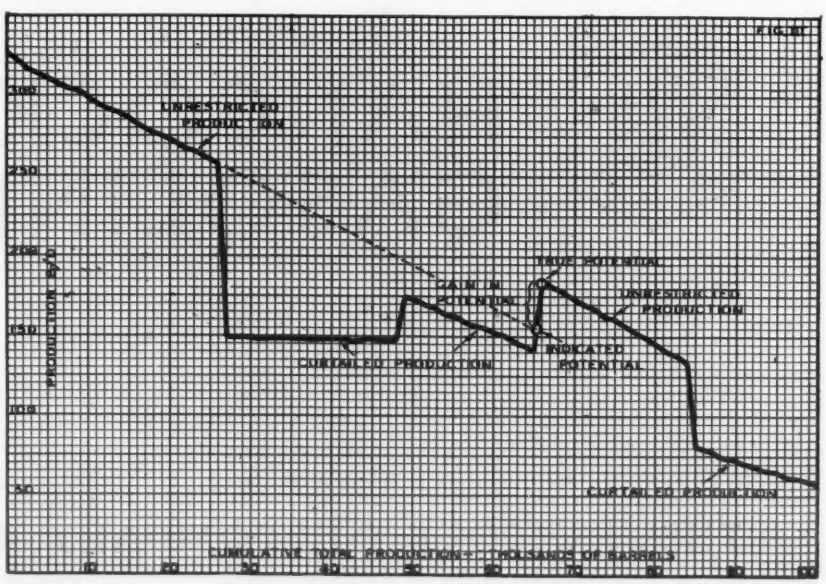


Figure III

Water Wells Indicate
Los Angeles City Field
As Early As 1857

By W. E. Brophy

(The author is one of the oldest geologists and independent oil operators in California, with a knowledge of the state's early oil history equaled by few if any men. His professional work has taken him all over the country.—Editor.)

The famous Los Angeles City field is not more than a mile from the City Hall and business center.

Outcrops of brea and asphalt were known to exist in the small canyons and ravines and the brea in solid form had been used for fuel in a small way for a number of years, but the first real indication that oil might be found was in the year 1857, when a contractor who was sinking a well for water at what is now the corner of Spring and Franklin Sts. at 800 ft. encountered quite a showing of heavy black oil, but no water. Hardly knowing what oil was at that time, as this discovery was made some two years before the discovery made by the famous Drake Well in Pennsylvania, the contractor abandoned the well and almost forgot about it, but many years afterwards, when oil was known to be valuable, he petitioned the Council to allow him to open up the well. His request was refused, as the location was then a city street while when he drilled there, it was only a cow path.

In the year 1865 a well was sunk on Temple St. to a depth of less than 400 ft. which developed a flow of gas that when lighted would burn all night. About half way between Los Angeles and Hollywood, a pioneer, Ivar A. Weid, drilled a well over 800 ft. deep which had a small showing of oil and gas but was abandoned at that depth.

Other wells were drilled near the city, but none encountered oil in paying quantities until the Maltman wells were drilled northeast of the Baptist College. Here about nine shallow wells were drilled by John S. Maltman. These wells pumped about two barrels per day each, and ranged in depth from less than 150 ft. to a little less than 300 ft. These wells were the first wells that produced oil of any value in the city and did not attract much attention.

Then a well was sunk at the corner of Patton and what is now Glendale Boulevard, which was the well that caused the development of the remarkable Los Angeles City Oil Field.

In the latter part of 1892, and early part of 1893, E. L. Doheny sunk a shaft to a depth of 155 ft. and it yielded a few barrels of oil per day. Soon after, he drilled a shallow well alongside of this shaft to a depth as reported at the time of 375 ft., and the reported production was about ten barrels per day. This well created much excitement among oil men and soon many other wells were started and Los Angeles or California's first real oil boom was on.

A Typical Early-Day Well

Soon hundreds of small derricks appeared in this part of the city and each derrick represented a producing well, as nearly all of the wells sunk in this part of the city were producers.

At a depth of from 630 to less than 800 ft. a productive sand was found that was of an average thickness of about 80 ft. and the average time it took to drill a well was from two to three weeks.

Production ranged from 20 to 60 bbls. per day, and while the wells slowly declined from this amount, it took many years for them to become small producers, that is, from four to five barrels per day, and some of the old wells that were drilled about 35 years ago still produce a few barrels per day.

There were a few wells that had a much larger production, but a few only. One well on Colton St. a few blocks west of Glendale Boulevard, for a time produced 300 bbls. per day and the noted Stanley well at Temple and Victor Sts. produced 400 bbls. per day and had a heavy gas pressure. A well at the junction of First and Second Sts. produced 200 bbls. per day for a time.

Most of the most prominent oil men in California, who reached fame and fortune in other fields later on, began operations in this field. There is every reason to believe that deeper and richer sands underlie the first sand developed here, but no effort was made to drill deep test wells and it is not probable now that these sands will ever be developed on account of the growth of the city.

With the discovery of cheap fuel in the city, the real industrial development of Los Angeles began, and soon manufacturing concerns began operations and large quantities of oil were used. Then railroads, hotels, laundries and all kinds of industries commenced using it.

The price of oil varied from time to time, but ranged generally from 75c to $1.50 per barrel. At one time, however, it reached as low a price as 30c a barrel for a short time. This was on account of a temporary over-production.

The average price of contracted drilling was $1 per foot, and if necessary one string of casing was furnished by the owner, but it was soon found that many of the wells did not need any casing at all as the holes did not cave and in many of them there was no water to shut off.

It was thus possible in many cases to drill a well to the sand at a cost of from $1000 to $1500.

In many respects, this Los Angeles City field was one of the most remarkable small fields ever discovered on the Pacific Coast.

California Operators Find
Deep Well Pumping Practical
With Modern Equipment

By E. P. Trout

To those faced for the first time with the problems of lifting oil from 6000 ft. and below, it is a surprising fact that extremely deep wells are generally easier to pump than some comparatively shallow wells. With proper analysis of well conditions, and the proper selection of surface and subsurface equipment, these wells can be pumped economically and efficiently. This fundamental fact is thoroughly established with the experiences connected with the pumping of over 200 California wells from below 7000 ft.

We shall discuss herein only the phase of pumping by means of the walking beam or standard pumping practice, the gas lift method having no part in this discussion except that it might be stated that the beam method is a much cheaper means of lifting oil from great depths unless large volumes of fluid are to be handled. Before discussing the selection of surface and subsurface equipment, let us first consider the possible rod loads on deep wells and some of their characteristics. For identification, we will term the total rod load as the "dead load," and the total fluid load or hydrostatic load on the pump as the "live load."

The work to be done includes lifting the oil to the surface at a rate of speed which is determined by the amount of oil which will flow to the well, and the capacity of the pump equal to this amount. The capacity of the pump is determined by the area of the plunger, the length of effective stroke and number of strokes per minute, the density of the fluid, the losses due to valve openings, closings, frictional resistance through valves in the passageway, and the leakage past the plunger.

As the oil is lifted in a series of repeated upward efforts on the part of the plunger, each time the plunger starts downward the upward flow of fluid stops, and the weight of the oil is shifted from the plunger to the tubing. Due to the shifting of loads, there is an actual downward movement of the oil in the tubing, caused by the oil load stretching and increasing the length of the tubing. Since the oil in the tubing comes to rest during each downward stroke, it must be started upward again by the plunger on each succeeding upward stroke; the plunger must therefore not only lift the weight of the oil but also accelerate the weight upwardly, and also overcome the frictional resistance offered by the tubing wall to the passage of the oil. In addition to the loads of oil weight, acceleration, and tubing friction, there are frictional losses due to plunger packing and rubbing of sucker rods along the tubing walls, all of which must be borne by the plunger, sucker rods and lifting mechanism.

Recently, many operators have been using sucker rods made of different diameters—the larger sections being installed at the surface end of the rod string, the object being to overcome the stretch in rods due to the weight of the load itself. After these rods are hung in the well, they elongate because of their weight, and there is a corresponding additional change in length due to the weight of the oil and the acceleration of the oil. This is best explained by visualizing these rods as sensitively suspended like a spring and extremely responsive to any load changes which may be placed on them; in fact, without a plunger attached to them, if the crank is started suddenly upward, there is an interval of time between the starting movement of the upper and lower ends of the rods. All these movements can be seen in action by hanging a weight in the hand. To this varied and erratic movement of the rods can be attributed most of the trouble encountered in pumping deep wells and the difficulty in obtaining practical volume results, which theoretical computations should warrant. It is apparent that rods should be selected whose design would give the most movement to the plunger when acted upon by their own weight. In addition, a reasonably long stroke should be used, with the smallest diameter of plunger consistent with the production desired and the plunger speed should be held at a rate equal to the maximum rate at which the oil will follow the plunger through the standing-valve passageway.

Summing up the above, the greater the bore, the greater the area of plunger

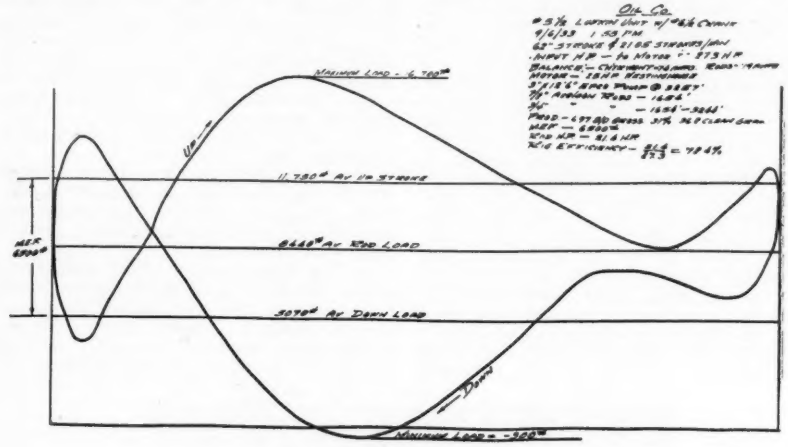


FIGURE 1

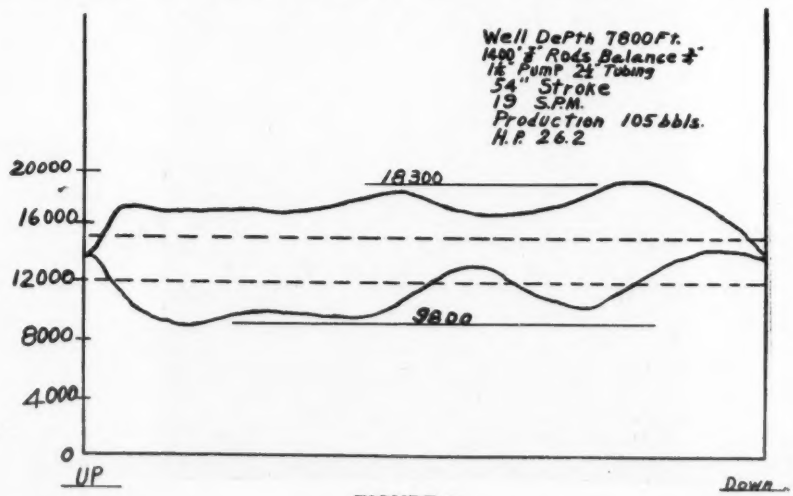


FIGURE 2

exposed to the fluid column pressure, and therefore the greater the fluid load, which means the greater the stretch, or, in terms of net plunger movement, means the less plunger travel. In deep well pumping, it is essential that the plunger travel be as nearly as possible the same as that of the polish rod, and to this on the end of a small rubber band held end a crank speed variation of 16 to 20 strokes per mniute is generally accepted for the most desirable speed where the polish rod stroke varies from 52" to 73".

In determining the proper speed, length, etc., it is essential that each well be studied as an individual problem, and only by experimenting with different stroke lengths and speeds can the maximum production be obtained from a given pump diameter.

We can sum up the experiences of a few California operators who have successfully pumped wells from below 7000 ft. Where the crude oil to be handled is fairly heavy gravity, containing reasonable lubricating qualities, and doesn't contain excessive sand or other undesirable elements, the insert liner pump is most commonly used. When the gravity of the oil is very light, the lubricating qualities poor, and with sand and other abrasives present, a standard liner pump with slightly greater clearance between plunger and liner is generally used. With 2" tubing the bores are usually 1 1/16" and 1¼", and with 2¼" tubing the bores are generally 1½" and 1¾".

Where the fluid levels are generally low, the relative hydrostatic pressure in the pump is high, and usually a 1 1/16" pump is recommended.

With regard to the selection of rods, combination strings are generally used; the upper portion of approximately 1500 to 3000 ft. are usually ⅞" and the rest ¾", depending of course upon hydrostatic load or the live load to be handled.

Table No. 1 is one rod manufacturer's recommendation for combination rod string.

TABLE I

Percentage of ⅞ Rods in ¾ and ⅞ Combination Strings in Relation to Pump Bore

Bore	Per Cent
1 1/16	25
1¼	27
1½	30
1¾	34
2	38
2¼	42
2½	47
2¾	52*
3¼	80*

*In the case of 3" and 4" pumps—100% ⅞ string is always recommended.

It is usually found that in those wells in which a high maximum load is experienced, a low minimum may be expected. The dynamometer card in Fig. 1 is a good illustration, the maximum load being 16,700 lbs., and a minimum load minus 300 lbs., making a total load range of 17,000 lbs. In this case the total load range exceeds the maximum peak load, which is very undesirable for any combination string of rods and not recommended by any rod manufacturer. The dead load, or rod load, of 6467 lbs., is approximately three-fourths of the accelerated fluid load of 10,233 lbs. Contrast this with Fig. 2, a 7800-ft. well; an ideal curve in which the minimum load of 9800 lbs. and a maximum of 18,200 lbs. represent a load range of 8400 lbs., or less than 50% of Fig. 1, a 3300-ft. well. The dead load in the deep well is 13,360 lbs. and is taken care of by the counterbalance crank, the effect of which on well loads is discussed later, and the live load of 4840 lbs. represents approximately 25% of the total load.

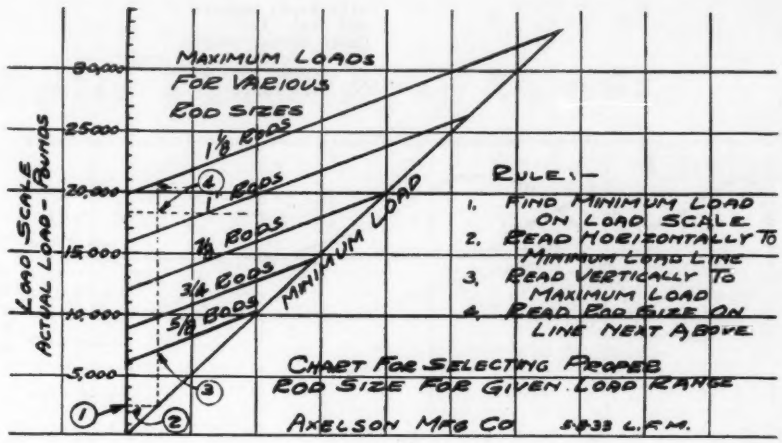


TABLE 2

Table two is one manufacturer's chart for rod size selections based on load ranges.

Fig. 3, a 3400-ft. well, represents a better operating condition than that of Fig. 1. Although the pump depth is approximately the same, the stroke is longer and the speed slightly less, the production of 1240 lbs. is almost double that of the first well under consideration. It is not the writer's intention to discuss in detail the characteristics of each curve; Fig. 3 is merely presented to show better operating conditions for similar wells.

Fig. 4 illustrates another serious condition in shallow wells in which the plunger of the pump is hitting fluid very badly near the bottom of the downward stroke. Even though this condition could be remedied with a smaller pump or by slowing down the well, it is pointed out that similar conditions exist in many comparatively shallow wells, which is a more severe test of rods than is generally found in properly conditioned exceptionally deep wells.

Table 3

Pump Bore, inches	1 1/16	2¼
Pump Depth, ft. ..	6,780	3,315
Gravity of Oil	42	27
Percentage of water	27	58
Surface Stroke, ins.	54	34
Fluid Load	1,140	4,870
Rod Load	10,800	5,280
Total Load	11,940	10,150

Table 3 represents a practical comparison for study. It is pointed out that although the total loads in both cases are very nearly equal, the active or 'live load' in the first example is 9.55% of the total load; yet in the second case it represents 43.56%. From the fatigue characteristics of steel, it is obvious that whereas the range of loading in the deep well is easily within safe working limits, in the shallower well when we ordinarily would assume the load to be less, we find the fatigue condition to be very dangerous which, in fact, is typical of wells in which rod trouble is a serious problem.

Considerable technical data has been compiled by a few major oil company engineers of rod stretch characteristics, rod fatigue, and plunger travel compared to polish rod travel, but no authentic information is available for a standard, as each well presents an individual problem. The crookedness of the hole, gas and sand conditions, plunger fitness, etc., make any formula or table somewhat empirical and only by actual test on each

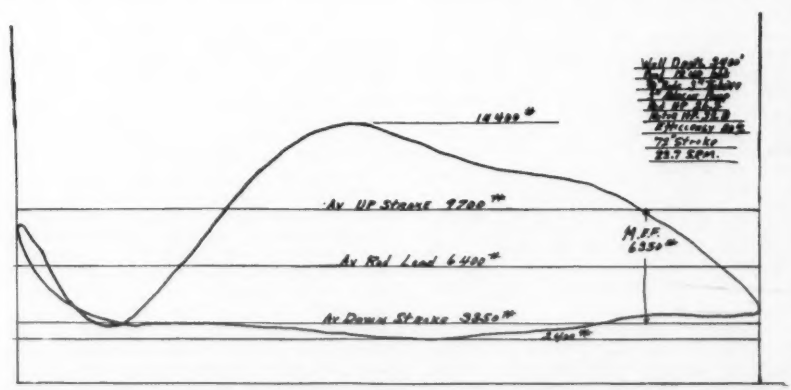


FIGURE 3

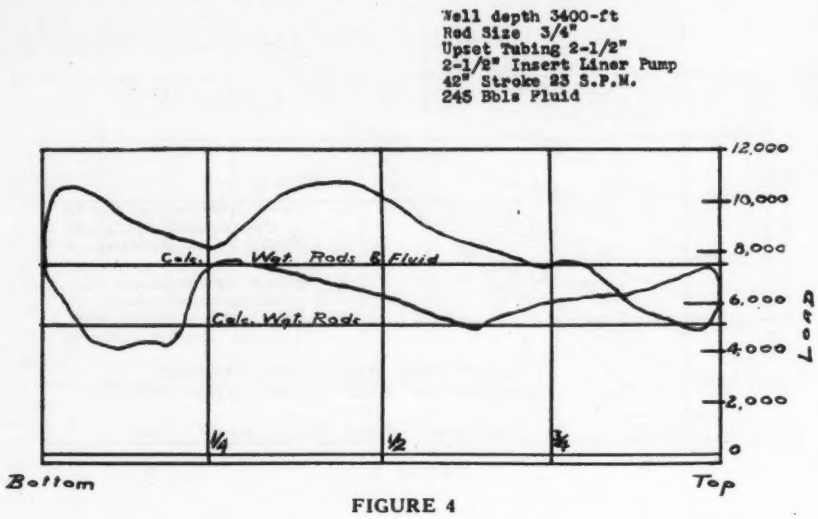
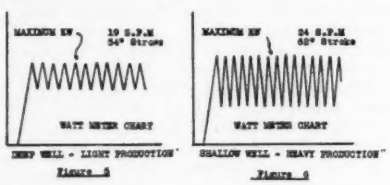


FIGURE 4

individual well can these characteristics be determined.

It is difficult to interpret the technical data of the two accepted test instruments used for this purpose without indulging in technical terms and phrases, but we would like to present a rough or simplified comparison of the effects of load range on an electric motor of a shallow well with that of a comparatively deep one. For example, conditions as in Table 3 can be exemplified by a watt-hour meter diagram roughly sketched in figures five and six.



A simple analysis indicates the wide load range even in a perfectly counterbalanced well in Fig. 6 as compared with less load range and smoother operation in the deep well. This is the basis of the opening remark that extremely deep wells are generally easier to pump than some common conditions in comparatively shallow wells.

This brings us to the point of properly counterbalancing the long string of rods in deep wells and the proper selection of surface equipment to insure the most economical means of actuating the rods. In counterbalancing a well, it is accepted practice to have the effective static weight of the crank counterbalance equal to the weight of the rods plus one-half the weight of the fluid. The beam or reciprocating type of balance is not discussed for it is considered an obsolete method of balancing; however, in some cases a combination of the beam and crank is used in a satisfactory manner on deep wells where the beam balance does not exceed 30% of effective balance of the crank type.

There are several types of crank balances being used successfully on deep wells; some with long crank arms with small auxiliary weight at the end; others where the weights are concentrated nearer the crank pin—requiring more weight. Cheaper cranks are generally made with the longest possible radius of gyration of the effective mass so as to reduce to a minimum for cheapness' sake. In these cranks, however, high bearing pressures are experienced on the crank shaft bearings, and larger and heavier bearings are required for this additional pressure. The force diagram in Figs. 7 and 8 clearly represent the bearing pressure of the two types of cranks, and it can truthfully be stated that the best motion is secured when the radius of gyration of the mass equals the radius of the crank pin.

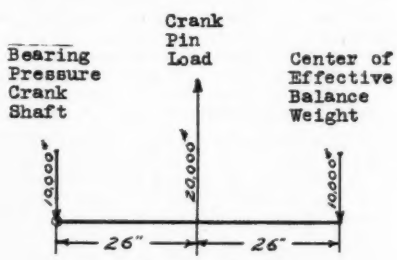


FIGURE 7

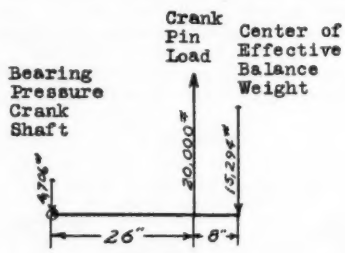


FIGURE 8

It is not, however, always possible to obtain these desired results in balancing deep wells as it is impractical to apply the desired weight at the radius of the crank pin.

The problem of balancing deep wells is actually an easy one. The dead load is usually a large percentage of the total load and is taken care of by the counterbalance crank, and when the live load is relatively small it is very easy to determine approximately half this load to get the desired balance.

The crank is actuated by means of a prime mover through a reduction gear unit or a standard bandwheel belt drive. The standard rig, an old accepted method of operating a walking beam, is cumbersome, expensive, inefficient, and not reliable for continuity of service and has been replaced by efficient and dependable reduction gear units. Complete records maintained by one major company operating in California show an average belt maintenance cost alone of 29.3 cents per day per well for 1932, and 30.1 cents per day per well for 1933—these figures derived from an average of 245 wells in the Los Angeles Basin and 186 wells in the Midway District. This cost, coupled with high lubrication expense on open bearings, clutch maintenance, general rig repairs, and labor for keeping the rig tight, made the maintenance cost of the standard rig incomparably greater than that of a well-designed reduction gear pumping unit. This is even more true in deep production where the present A.P.I. specifications of standard rig are not suitable for such service.

There are several makes and types of reduction gear units in successful operation, some of which have operated continuously without any maintenance cost other than lubrication for the past eleven years. On the general types, including chain drives, single helical, worm, and double helical or herringbone gear—both single and double reduction, the single reduction herringbone gear unit has met with the greatest success. Higher efficiency and lower maintenance cost is due to few moving and replaceable parts. The general gear ratio of ten to one is ideal for single cylinder gas engine drives as the belt radio is approximately one to one; whereas, in double geared units it is necessary to speed up pinion speed to secure the desired crank speed which is contrary to good engineering practice. They are likewise ideally suited for multi-cylinder gas engine drives and medium speed electric motors, but are not suitable when relatively slow crank speeds are essential.

It is essential that in deep well pumping a unit should be selected that is designed especially for oil well service, that will withstand the pulsating and shock loads of oil well pumping, and not merely an industrial gear and gear box with a crank on the slow speed shaft. Industrial gear units with factors of safety of two to one for oil well use likewise have no place in the oil fields. A factor of safety between four and six to one have proved far more economical in oil well operation and should be maintained for practical results.

Reduction gear units should be rated on a time and wear basis. With the horsepower based on a life of twenty years of continuous service at rated capacity, obviously a longer life can be expected at under-rated capacity loads. Some pumping unit manufacturers have made considerable headway in this respect, basing their horsepower ratings on a tooth pressure load, the allowable tooth pressure derived from noting the wear based on several years' continuous operation. The ratings should be based upon an average load with sufficient factor of safety to take care of the peak load, which is generally figured 1.75 time the average load.

Present Status Of Bottom-Hole Pressure Work Outlined

By Stanley Herold

Once a petroleum engineer about to visit various oil fields throughout the country was asked to investigate the use made of data on casing and tubing pressures. On his return some months later he reported: "I find no use made of them. They are merely something to take." This was almost the truth. The best that can be said of such pressures is that they, like the reading of a medical thermometer, do not diagnose the illness of a reservoir or patient, but only indicate the daily response to treatment.

For many years the engineer's attention in the field was confined to the wells with their equipment. Gradually, however, more interest has been diverted toward the reservoir which, after all, really gives the wells the value they have. To know the possible changes in drainage caused by production allotments based first on one formula and then on another, to determine the best location for the next wells to be drilled, to be guided in the matter of depth in the redrilling and recompletion of wells, to determine the best size of tubing and its best position from bottom at intervals during the natural decline in the well's rate of production, to determine the function of gas in the production of oil, to compute reservoir volume of oil, ultimate production and percentage recovery, in fact to diagnose all pertinent events and conditions within the reservoir, events and conditions which influence or should influence our economic field practice, is the aim of technologists at the present moment. Intensity of pressure at particular spots within the reservoir, and the distribution of this intensity throughout the reservoir, whether wells are shut in or on production, are matters which promise, when combined with other data we have long been accustomed to note, to give a better analysis of affairs not subject to direct vision in advance of actual production. Casing and tubing pressures are inadequate; only bottom-hole pressures can reveal the state of the reservoir in the vicinity of the wells, and only actual pressures measured at various depths within the wells can reveal what is going on in those wells. It is believed that such data will be valuable for all wells, whether these are producing naturally, by gas lift or on the pump.

The idea of measuring pressures directly is new. Six years ago any proposal to close a well and determine the existing pressure at the bottom was ridiculed by some engineers, was believed to be a possible aid to theory by others, and was enthusiastically accepted as an aid to practice by an exceptional few. Now the idea is rampant among us. Some five or six pressure devices are already on the market, and several more are certain to appear in the coming months.

This is exactly where we are today. We have the devices—perhaps not the good ones we shall have later—we are taking the readings, we are trying out various methods of recording the data on maps and charts, and we are speculating on the methods of making proper use of them after all such beautiful records are drawn and blue-printed or photostatted. The problems of interpretation are not simple, and the full develpoment of the subject may require several years. It is in fact an even bet at the present moment that either much or nothing of practical use will come out of the studies. As with most other innovations of the past, considerable secrecy is maintained concerning interpretations and applications. This secrecy, as long as it exists, will of course delay a general use of the apparatus and a general acceptance of principles based upon interpretations. It is claimed that such secrecy is essential from the point of view of the operating company in consideration of drainage factors which otherwise might be revealed. This fear of scientific achievement has arisen before, namely, in connection with well-surveying. The peculiar feature of such fear is that it weakens as time goes on, and eventually we find the most friendly cooperation and exchange of data among operators. When that comes about we really make progress in technical development.

Types of Pressure Devices

The instruments now in use for the recording of pressures at depth differ somewhat in design. One has a coiled hollow tube which tends to uncoil from pressure transmitted to its interior. A clock causes a paper to travel slowly past a stylus attached to the tube. Obviously the depth of the instrument must be recorded against another clock at the surface in order to correlate this depth with the record of pressure.

A second instrument has a cylinder with a piston. Pressure transmitted to the interior of the cylinder causes the piston to move against a spring. No clock is included, but a recording paper is shifted at a desired depth by suddenly dropping the instrument three or four

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Maximum wear occurs on the few gear teeth that take the peak loads or accelerating loads of the rods and fluid, and since the peak occurs for such a short duration, the few gear teeth on the gear wheel taking this load are subject to the maximum wear, for the gear wheel is made of softer material than the pinion. It is not practical to rotate the gear wheel in relation to the crank as soon as wear occurs on the teeth that take the peak loads, for this wear would cause back-lash in the gears, and the shock or pound of such back-lash would be transmitted to the rods. A horsepower rating based upon tooth pressure, per inch of face per inch of diameter for a given life, would insure the user the expectant life of the gears, and obviously if he desires only a few years' service he could make his selection accordingly. At high ratings for short life of gears, the unit would have to be protected with shaft and bearing sizes suitable for high torque and bearing loads.

One important feature, which is not fully appreciated by many producers, is the proper lubrication of geared units, a feature one would think would be given greatest consideration and proper study, for all marketing oil companies maintain large lubrication engineering staffs to meet any type of lubrication problem. Yet it is a common practice for the producing departments to order the cheapest oils to meet the manufacturers' general specifications. This no doubt is a result of past experiences with the lubrication of standard band-wheel rigs that were equipped with loosely fitted open bearings, which were in reality not a lubrication problem. The best possible lubricating oil for precision gears is unquestionably the most economical oil, for the added few cents per gallon is negligible compared to the added life and performance of the gears. Of a given manufacturer's S. A. E. rating, it is recommended that the best dewaxed oil of the lowest carbon residue that will withstand the highest pressure be used.

The types of prime movers will not be discussed, for their selection depends upon too many factors for a general study. The location of the well, the type of service which is required, the cost of electric power, the amount of gas available, and other items are a few factors that determine their selection. It is well, however, to state that the drive from the prime mover to the reduction gear unit should unquestionably be a vee-belt drive, as vee belts are shock absorbers of the impact loads from the unit to the prime mover. This type of drive, if properly designed with suitable belts for the load, is highly efficient and adds an extended life to both the geared unit and prime mover.

From the above the producer can appreciate the necessity of proper selection of pumping equipment. His profits lie in the continuity of his production, and returns from his production against charges of interest on initial investment, operating expense, maintenance cost and replacement cost.

It is fundamentally true that the larger the investment in initial cost of equipment, the lower will be the other three phases of costs. In case of extremely deep wells, this fact is more sharply emphasized than in the average case. That these costs increase rapidly with the depth is well known. It is, therefore, the exercising of excellent judgment to operate the best type of equipment that can be purchased—if the hole is to pay out in profitable amounts as a deep pumper.

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feet through slack taken for that purpose in the line.

A third has a cylinder and piston like the preceding one, but the paper is shifted by a thermo-motor. As the temperature increases on depth the stylus hits a different point on the paper. Here the record between depth and temperature is lacking, but the instrument can be held at a succession of positions in the hole with known amounts of line out, and the corresponding positions on the record can be easily detected and checked off against the depth.

Still another instrument consists merely of an ordinary pressure gauge at the surface. The gauge is attached to a hollow wire which is let down the well. After all liquid is blown out of the tube with compressed hydrogen, the gauge is read and a correction for the weight of the hydrogen from the top to the bottom is made.

Several single-shot types consist of an ordinary pressure gauge, photograhpic camera and batteries for light, all mounted in a tube to be lowered into the well.

Detailed descriptions of some of the devices are given in published articles. A partial list of material on bottom-hole pressure work is given below.

The ideal instrument, it seems, would be one giving at the surface a continuous and sufficiently accurate record of both pressure and temperature at depth. The part of the apparatus that is to go down the hole must be inexpensive, for occasional losses are unavoidable.

Methods of Tabulating Data

Some engineers have attempted to determine bottom-hole pressures by indirect means. For example, if liquid stands at a definite level in the hole the pressure at the bottom is equal to the weight of the column of liquid, and this in turn is equal to the formation pressure. If the pressure is such as to cause the well to flow naturally, the well may be closed and the pressure indicated by an attached gauge can be added to the computed weight of the column of liquid. Inaccuracies by this method are unavoidable simply because the fluid in the hole is generally not homogeneous. Separate computations for oil, for gas, and for water in the well must be made, and often it is difficult to determine how much there is of each of these. Furthermore, a method depending upon computations can not be applied conveniently to a well in the act of flowing. By means of pressure devices a sufficient accuracy is obtained under either closed or flowing conditions.

Time is required for a well to attain its maximum pressure after being closed in. One of the first questions confronting engineers in taking such pressure readings pertains to this matter. Will the amount of pressure attained in twenty-four hours be satisfactory, in view of the fact that the pressure will continue rising, even though at a very slow rate, for three weeks, for three months, or for a longer time when much gas is present with the oil? For the present we can be content, it appears, with an accurately timed shut-in which will give us at least ninety per cent of the final maximum pressure. Ordinarily the twenty-four-hour period will do this. A period greater than seventy-two hours will seldom be necessary.

As we may expect, several methods of tabulating and recording graphically the pressure data by curves, maps, and profile sections are already in use. Curves are perhaps best confined to wells and well performance. Contour maps and profile sections are quite suitable as applied to the reservoir, and these necessarily will be dated because of progressive underground changes during the history of production. The use of the contour maps is well established and uniform in practice, but differences appear in the set-up of profiles. Some engineers are referring the data to an arbitrarily selected horizontal line at depth in the field. Where the structure is pronounced it is obvious that such a line will refer to one producing zone in one part of the field and to another zone in another part. To meet this situation several such lines are used in one field. To an engineer with considerable geological training it would seem more rational to refer all data to a position definitely located below the top of the producing horizon or zone, letting this reference position dip or plunge with the actual structure.

For either method of reference it is clear that inasmuch as different wells have different penetrations, and inasmuch as ordinary field practice will call for readings at convenient depths in minimum time, subsequent adjustment of the observations will be necessary so that they will pertain to the selected position of reference. This can be done, of course, by adding or subtracting the weight of the fluid for the definite footage involved as between the position of the instrument at the time of the record and the desired reference horizon in the vicinity of the well.

Interpretation of Data

By pressure we of course mean intensity of pressure. Like the flame of the candle it is merely a phenomenon. If we attempt to explain it in terms of molecules, we speak of minute particles of matter so small that we have never seen them, and if we cite our experience with it, we offer no explanation. Yet we are to interpret the behavior of natural reservoirs and the performance of wells in terms of pressure. Perhaps our experience is sufficient to carry us through the desired analyses. If so, the way is clear. We must delve at once into the science of reservoir mechanics. To do this we do not confine ourselves to pressures alone but to all of seven functions of reservoirs; namely, to pressure, volume, velocity, acceleration, energy, power, and time. A complete understanding of the natural reservoir requires all of these. Volume is an obvious entity; it is simply the oil, gas and water which we encounter in the reservoir. Velocity is only another name for the rate of production, a measurement we have been noting at wells for years. It is the rate at which the volume changes. Acceleration is the rate at which the velocity changes, or, as we may say, the decline in the rate of production. This also we have observed for years. Energy is the mathematical product of pressure and volume when the latter are expressed in numbers. It is nothing more than the multiplication of pounds per square foot and cubic feet, the result being foot-pounds. Some engineers consider energy to be a thing apart from oil and gas in the reservoir, but the notion is clearly absurd. We can not say that oil and gas shall belong to individual owners in a field while the energy shall belong to all such owners combined. Power is the rate at which the energy of a reservoir is changing. And time needs no definition.

It is absolutely safe to say that we shall never get anywhere with bottom-hole pressure without the use of mechanics in terms of the seven functions above. By such a science only can we learn of the movements of fluids underground and therefore unseen. After mechanics comes thermodynamics. This deals with pressure, volume, energy, heat and temperature. We shall never get anywhere with pressures off bottom in producing wells without the use of themodynamics. This is the science which is concerned with heat engines, and that is just what a producing well is from top to bottom. It may have no wheels to go round, but wheels do not make an engine. It is simply a device for converting heat energy into mechanical energy. In order that gas may take oil at the bottom of a well and put it at the top it expands, loses its heat, and therefore lowers its temperature. But the oil is given more energy in being placed at a position varying from 1000 to 10,000 ft. farther away from the center of the earth, depending upon the depth of the well.

We may wonder whether engineers really know what they are getting into by introducing the subject of pressures at depth. Very few, if any, are equipped to handle the subject. Worse than that, none of our departments of petroleum engineering at our universities are attempting to teach mechanics and thermodynamics.

But, some may ask, is it not possible to accomplish something practical in the field with pressures regardless of the lack of training in the necessary sciences? Yes. Just as Kepler, after observing the planets for twenty years, formulated his three well-known planetary laws, so can the engineer, after much effort in observation, come to some very definite and accurate conclusions regarding reservoirs and wells. But we must not fail to note that Newton, who was well-founded in fundamental theory, worked out Kepler's laws in twenty minutes without looking through the telescope. While there are no Keplers and Newtons around our oil and gas wells today, we can nevertheless assume that the interpretation of pressures can be done advantageously in a shorter time if we know the basic theory involved. If we persist in proceeding without theory, the probability is that many of our reservoirs will be depleted before we know what the data of pressures indicate to us.

Partial List of Recent Articles on Bottom-Hole Pressures

C. V. Millikin and Carroll V. Sidwell: Bottom-Hole Pressures in Oil Wells, The Oil Weekly, May 15, 1931.

Stanley Gill: New Apparatus for Precise Measurement of Bottom-Hole Pressures, The Oil Weekly, April 4, 1932.

Jack Logan: Higher Recovery—More profit through Proper Control of Bottom-Hole Pressures, The Oil Weekly, May 16, 1932.

C. V. Millikin: Reservoir and Bottom-Hole Producing Pressures as a Basis of Proration, The Oil Weekly, August 8, 1932.

(Author?) Instruments for Measuring Subsurface Pressures, The Oil Weekly, February 20, 1933.

Park J. Jones: Analytic Determination of Bottom Pressure, The Oil Weekly, March 6, 1933.

E. V. Foran: Bottom-Hole Pressure Interpretations, Oil and Gas Journal, April 21, 1932.

H. D. Wilde: Measuring Bottom-Hole Pressure is Important in Production and Development Control, Oil and Gas Journal, June 16, 1932.

D. G. Hawthorn: Rapid Advance Made in Perfecting Instruments for Exact Recording of Subsurface Pressure, Oil and Gas Journal, April 20, 1933.

E. K. Parks and C. W. Gibbs: Instrument and Equipment for Recording Subsurface Pressures, Petroleum Development and Technology, A. I. M. & M. E., 1934.

Tideland Development Limited To Approximately 50,000 Acres

By Frank Morgan

The western boundary line of California runs from the boundary line between Mexico and the United States to the boundary line between Oregon and California, and extends three English miles into the Pacific Ocean and includes all the islands, harbors and bays along and adjacent to the coast. According to the U. S. Coast and Geodetic Survey, the length of the coast line of California, including its coastal islands, is 1190 miles.

The Tideland Leasing Act of May 25, 1921, authorized the Surveyor General of the state to grant prospecting permits on the state owned tidelands to be followed by leases in case of oil discoveries. The area thus thrown open for exploitation was 3570 square miles, or 2,294,000 acres, less certain areas negligible in total acreage which were withheld and restricted against the granting of prospecting permits.

This vast area which fell within the Tideland Leasing Act was, of course, not available for development over its entire expanse, owing to the practical limitations of drilling beneath the ocean floor. These limitations depend on the slope of the beach, the depths of the ocean water and the corresponding distances offshore wherein drilling is possible. It may be assumed that the California coast will, on the average, permit drilling for a distance of one-half mile offshore and, on this basis, the total area made available for drilling by the Tideland Leasing Act was approximately 400,000 acres.

A large portion of the California coast may be readily eliminated as prospective oil territory, this due to the presence of metamorphic or crystalline rocks which are quite definitely foreign to oil possibilities. The coast line is dominated by sedimentary deposits of the type which might contain oil over a distance of perhaps 25% of its total length. Thus, the area made available for drilling under the Tideland Leasing Act wherein there is any possibility for oil production is reduced to approximately 100,000 acres.

Of that portion of the coast line where sedimentary formations prevail, it is estimated that about one-half of the total distance fronts on the present oil bearing provinces or basins of Southern California; namely, the Santa Maria, Ventura and Los Angeles Basins. The remainder of the sedimentary deposits along the coast are in districts which are of questionable value from an oil production standpoint, either due to adverse geological conditions, including unfavorable structural features and age of beds, or due to unfavorable results of test drilling. With these conditions in mind, it may be stated that the likely tideland area which was made available for drilling by the Tideland Leasing Act approximated 50,000 acres.

The successful development of oil in any portion of the more favorably located tidelands must, of course, depend on localized conditions of geologic structure. The coast line is, for the most part, oblique to the controlling structural features of the richly productive coastal basins and this has inevitably resulted in an offshore trend of certain structures which are favorable for oil accumulation. The majority of the apparent structures along the coast, both upland and offshore, have been quite thoroughly tested during the last six years. Certain prospects have been uncovered which are indicative of offshore production at Huntington Beach, Venice, Summerland, More Ranch, Capitan, and Hollister Ranch; however, the only areas on the coast where successful commercial production has been developed from offshore wells since the inception of the Tideland Leasing act are Rincon and Elwood.

The proven tideland areas in these two fields aggregate perhaps 400 acres which is a rather startling figure in comparison with the large acreage originally made available for tideland exploration.

There are certain well known prospects for development along the coast, but, unless the present legal situation is reversed or unless a national emergency arises which demands development at any cost, it is not likely that these prospects will be explored. The Tideland Leasing Law was suspended by legal act on Jan. 17, 1929, and officially repealed on May 28, 1929. The repeal provided that after Sept. 1, 1929, no prospecting permits or leases should be issued for tidelands saving, however, the rights of applicants prior to Jan. 17, 1929.

Fresno Derrick Up

Western Gulf has the derrick about ready for its second well on the S. P. lands, west Fresno county. Location is on sec. 11, 17-15, about 20 miles almost due north of Coalinga and close to Cantua Creek, a region where there has been some drilling in years gone by. Bell & Loffland Drilling Co. have the drilling contract.

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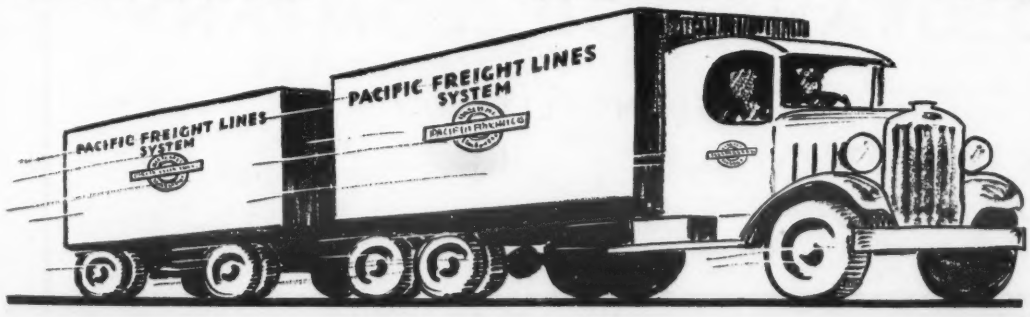

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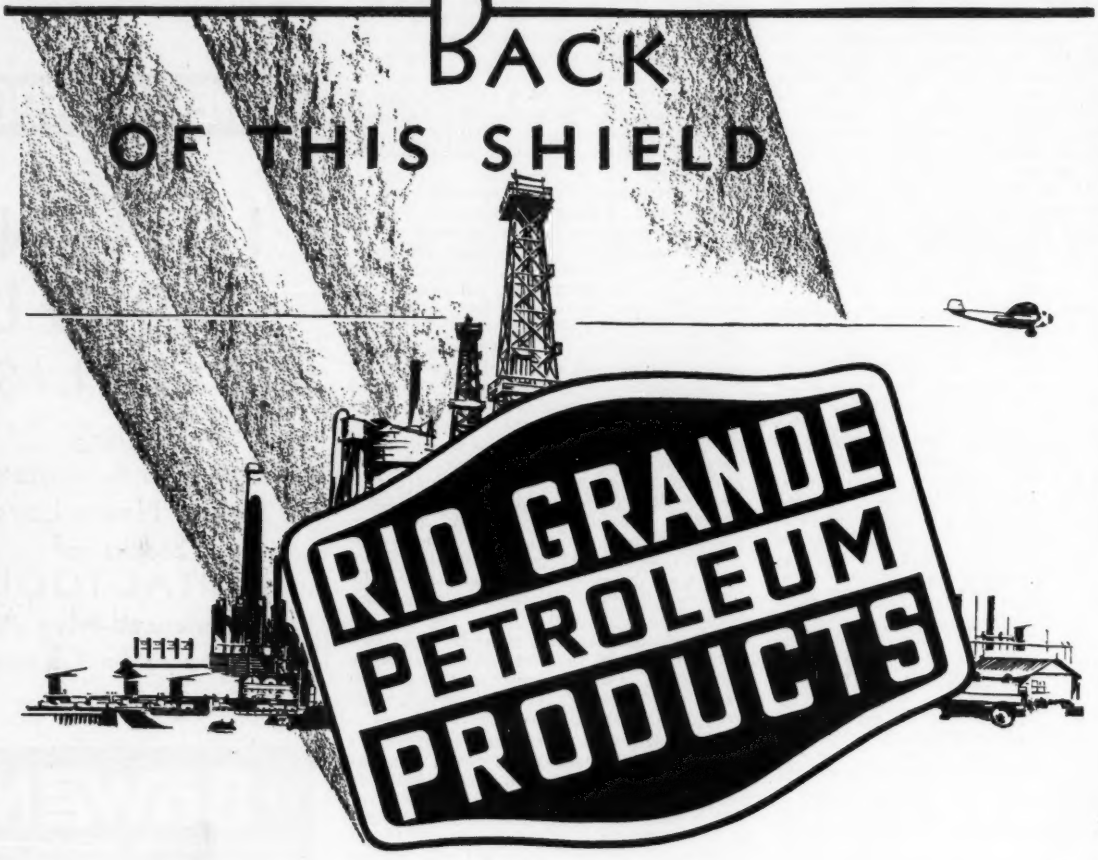

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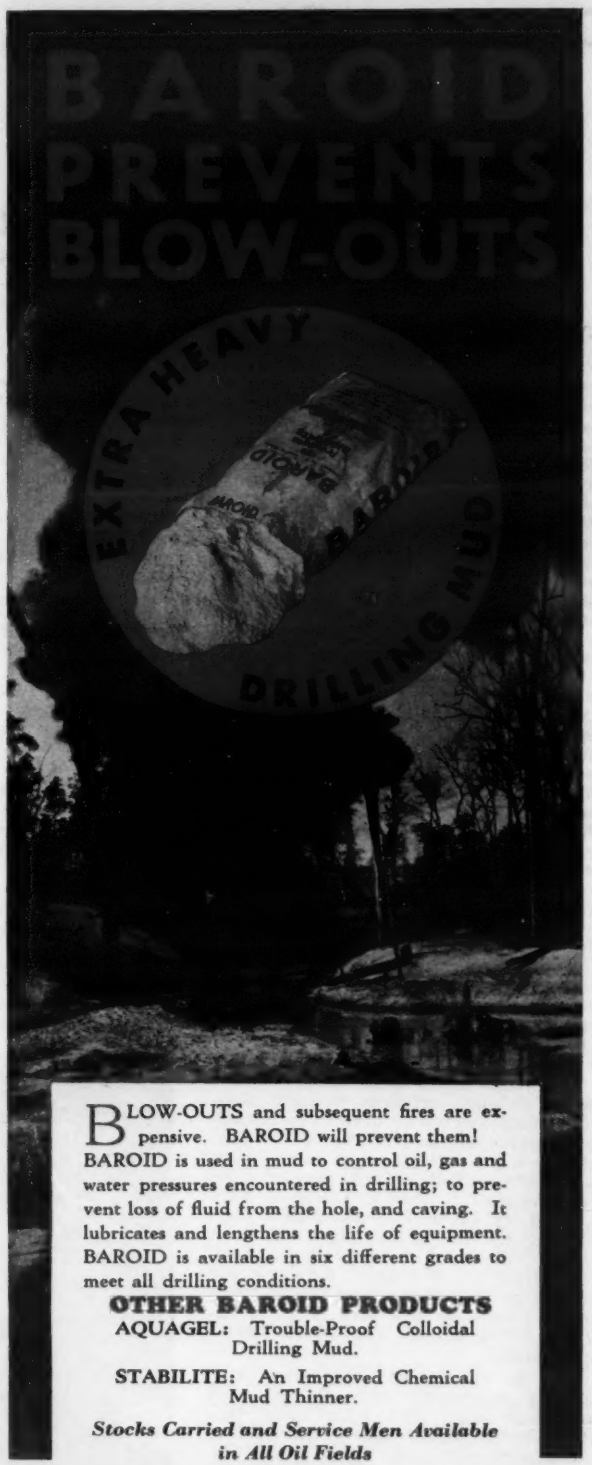

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Development Of Application Of Electric Power To California Fields

By H. C. Hill
General Electric Co., Los Angeles

Electricity today is accepted by most operators as essential to the proper operation of their oil fields. Not so many years ago it was an experiment, but the flexibility, safety, economy and dependability have earned for electricity a well deserved place in the oil industry.

The first record we have of the use of electric motors for oil well pumping was in 1892 at Sistersville, West Virginia, where five three-horsepower motors were installed. They endeavored to pull the wells also, but with such small capacity the work was slow and tedious. After a few years the wells played out and the equipment was removed. The next installation was by the Forest Oil Co. in 1898 in Washington county, Penn., and the equipment is still working.

The only information available indicates that the first pumping motors in California were installed in the fall of 1909 by the Pacific Light & Power Co. on their lease in the Salt Lake Fields near Los Angeles. They were 5/15 Hp. single speed Y-delta, 440 volt, 50 cycle motors. The double rating made it feasible to pump and pull but it was necessary to change pulleys. The motors had back gears and were very noisy. Improved economy in pumping which was obtained, resulted in many other installations of these motors and larger ratings of 6⅔/20 Hp. were used. In 1912 the General Petroleum Corp. on the Nevada Petroleum lease at Taft equipped a number of wells and this was the experimental and proving ground where our modern double rated 2-speed oil well motors were developed.

The double-rated single-speed Y-Delta motor, although excellent in many ways, left considerable to be desired in flexibility of operation, and in the fall of 1912 the two-speed variable-speed motor made its appearance and in 1913 many of them were installed. Notable examples were C. C. M. O. Co. at Fellows, British Consolidated Oil Co. at Coalinga, and Kern River Oilfields, Ltd., near Bakersfield. Today there are thousands of them in use throughout the world. The ratings were increased until we now have 15/30, 15/35, 20/50, 25/55, 25/65 and 35/75 horsepower sizes.

With the changes and improvements of pumping equipment such as reduction gear, floor jacks, band wheel units, etc., more constant speed squirrel-cage induction motors were used. They are less expensive and simpler than the double rated motors but separate means must be provided for pulling and servicing the well, such as a portable hoist. The double-rated motor permitted pumping, pulling, bailing and re-drilling by simply pushing a button or throwing a switch, and was available day or night, rain or shine. Many operators installed the double-rated motors when building the rig and used it as a stand-by unit while drilling, and thus it was available for pumping and servicing when on production.

Many shallow wells and the deeper ones with low production permit of continuous slow-speed pumping as low as one stroke per minute. For these jobs, small squirrel-cage motors have been installed in great numbers in the past few years. Where double-rated motors were installed, they can be used as a countershaft and driven by a small motor with chain or "V" belt drive. Where no double-rated motor or reduction gear is installed, many types of speed-reducing units are available. The motorized gear reducer makes a very simple, rugged and inexpensive drive for this work and hundreds of them have been installed in the past two years.

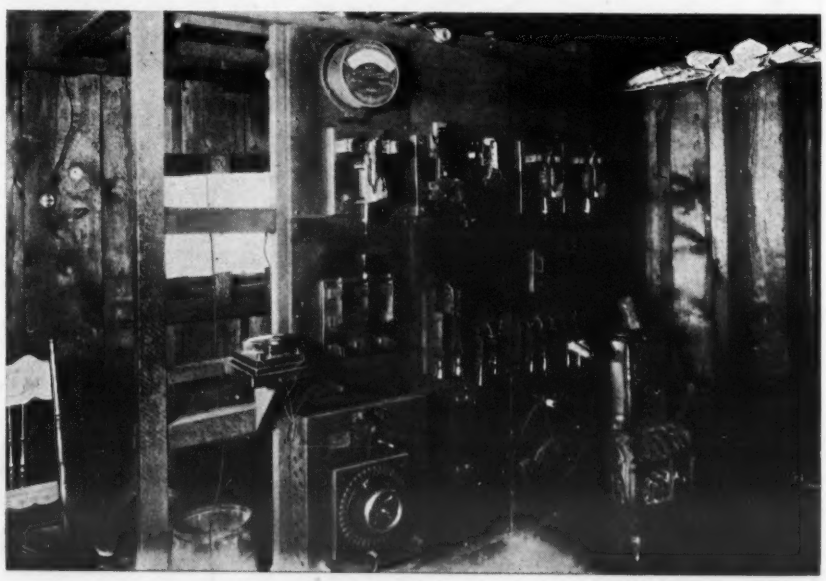
Standard motors have been used for many operations in the field, such as gathering and line pumps, dehydration, etc., but their application does not warrant space in this short review.

Electrical drilling made most of its progress in California, and the following information has been obtained from available data and from the men who helped in pioneering this work.

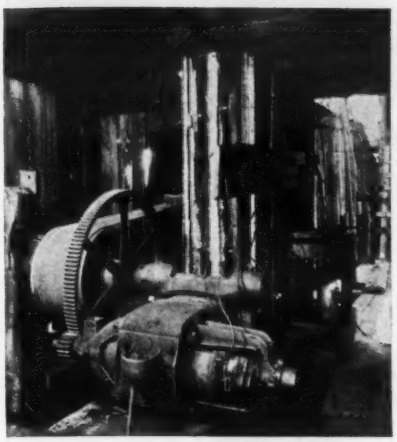
In March, 1912, the General Petroleum Corp. started drilling a well on the Nevada Petroleum lease at Taft and installed a 50-h.p. 720 Rev. wound rotor induction motor and control. Cable tools were used and a 1000-ft. well was successfully drilled. Some difficulties were experienced but these were soon overcome. A finer control was desired and on the subsequent installations two controllers were used, thus giving small increments of speed change. Ratings of 75 h.p. were used in many cases and several years later some progress was made by a scheme employing twin motors which divided the load between them.

On Feb. 1, 1921, the La Habra Midway Oil Co. started a well near La Habra with cable tools, and drilled to a depth of 5445 ft. The well was completed July 5, 1923. This was the deepest hole in the world drilled electrically with cable tools up to that time. A 75-h.p. wound rotor induction motor was used and a write-up at that time indicates that its operation was entirely successful and the entire electric bill was only $5375.14.

Rotary drilling was coming into general use and in the fall of 1919 the Western Union Oil Co. (now owned by Shell Oil Co.) on the Harris lease near Lompoc, spudded in the first electrically driven rotary drilled oil well in California. "Joe" Dunn of the National Supply Co. was drilling foreman on the job and offers the information that everything went along in good shape except some trouble with controller fingers and some chain trouble. The well was drilled to 3000 ft. by rotary and finished to 4710 ft. by cable tools. A 75 h.p. 900 r.p.m. wound rotor induction motor was used on the drawworks and was driven through a chain driven countershaft. The mud pump was a 5x10 and driven by a 50 h.p. wound rotor induction motor.



Switchboard Control for Generators. Installed About 1898.



15-h.p., D-C., Shunt-wound Motor and Rheostat Installed About 1898.

The cost of electricity was about $10.00 per day and estimates are that the steam cost at that time would have been about $150.00 per day.

The success of this installation caused electric rotary drilling to advance very rapidly. From 75 h.p., motors went to 100 h.p. and then to 125-, 150-, 200-h.p. and today double rated Y-Delta drilling motors of 300/100 h.p. and even larger are available. Some installations have been made using two standard 125-h.p. drilling motors chained to the drawworks. This permits drilling with either motor and makes available the total power of both motors for coming out of the hole.

Considerable difficulty was experienced in the early days with drum controllers and the magnetic drilling panel was developed in Los Angeles and entirely overcame this trouble. On many installations two and three wells could be drilled without replacing the control contact fingers.

The differential electric rotary drilling equipment made its appearance on Dec. 24, 1923 and did a great deal to advance the use of electricity in rotary drilling.

Mud pumps increased in size as rotary drilling progressed and today 125 and 150 h.p. motors are being used in California. The principal difficulty in the use of electric motors with mud pumps was the lack of slippage when the pump stalled and the inability to function properly while compounding the pumps. This problem, however, has been satisfactorily solved and proper control is available to permit the same action on electric driven mud pumps as on steam driven ones.

The spread of electric power in the oil fields has naturally lead to its uses for many other purposes. Electricity is used for water pumps, gathering and shipping pumps, vacuum pumps, compressors, circulating pumps, machine shops, heating, etc.

The electrical manufacturers have kept abreast of the times and are in a position to furnish motors, control and equipment in various types, such as splash-proof, vapor-proof and explosion-proof, which will meet the underwriters' rules. Many installations of these types of equipment have been installed on pumping and drilling wells. Many other applications of electricity have been made in the oil fields but space does not permit discussion of them.

Independents In Oil Industry Protect Interests By Organization

By John B. Elliott

The one contniuous need of independents in the oil industry is effective organization. It is only by being banded together into a single harmonious unit that they are able to protect their interests and to make themselves felt in all ways affecting the industry. It is so obvious that the individual can accomplish little or nothing by himself that little argument is needed in favor of organization. Both independent producers and refiners have had this lesson brought home to them too many times in California to require anything to persuade them on this point. As has been said, if they do not "hang together, they will hang separately."

The past two years have witnessed such extremes of governmental regulation and control of the industry that the situation, as affecting the independents, is today more acute than it has ever been. Few individuals, standing alone, can afford to send representatives to Washington or Sacramento to protect their interests as is now so often required. Appearance before so-called representative bodies or committees of the industry has become almost a continuous function. There is every probability that this will continue. As a matter of fact, the California independents have only been preserved from complete demoralization by the fact that they were, to an extent, banded together and able to present something of a united front when needed. Alone, none could have done anything, but stading together, a very great deal has been accomplished. In this way, expense has been minimized and effort effectually concentrated. Only very few organizations of oil men throughout the United States are truly independent. Many have started out to be independent but have not proceeded far until something happened to them. They have either been subsidized or crushed. It is only by continuous vigilance that such an independent organization can be maintained as a useful unit.

Record of Accomplishment.

The Independent Petroleum Association of California has perhaps the best record of accomplishment of any independent oil organization in the country. It has been organized for many years and has taken part in many battles for the independents. The Independent Petroleum Association of California can say with due modesty that most of its fights have been successful. True, most of these battles have been on the defensive, but the results have been highly beneficial to the industry and the general public.

Since the overwhelming defeat of the Sharkey Oil Control bill by a popular vote of the citizens of California, the Independent Petroleum Association has been recognized as the only effective organization to be found at all times on the side of the independent producer and refiner. The great victory of the independents in the defeat of the Sharkey bill did more to unify the independents and to educate the people as to the true facts about the oil industry than any single occurrence in the recent history of the business. The voters of California are not likely to forget this education for many years to come. Since the Sharkey bill defeat, the Independent Petroleum Association has been almost continuously and effectively represented both in Sacramento and in Washington, in legislative matters, with the result that it greatly influenced the final results in those places.

Defeat of the Oil Control Bill

The most recent notable victory was the defeat of the Ickes-Disney Oil Control bill at Washington during the last session of Congress, when the Independent Petroleum Association of California, combined with the Independent Petroleum Association of Texas, and a few other independents throughout the country, put up one of the most stubborn and successful contests that has been seen at the national Capitol. The Ickes-Disney bill was finally defeated in committee of the House of Representatives by an overwhelming vote as a result of the efforts of this organization and its associates.

These continuously successful results have been accomplished perhaps with a maximum of effort but with a minimum of expense to the individual members. The lesson is plain. The Independents must remain closely banded together and support strongly a central organization for the protection of their individual interests.

Producer and Refiner Protected

The Independent Petroleum Association of California has conducted its battles in the interest jointly of the independent producer and the independent refiner. The interests of these two are alike, as has been frequently demonstrated. The course of the organization has been consistent and it has yet to make awkward explanations of previous commitments and activities.

Also the Independent Petroleum Association has had no other interests to serve excepting the interests of its independent membership. This has not been true of some other organizations which have frequently found themselves in an ineffective attitude because they were not actually independent. The organization too, has the respect of the public, and its influence is recognized not only with the people at large, but with their legislative representatives. Every independent producer and refiner should consider the future of the industry as a whole and his own individual future, and realize what position he would be in, if there were no central organization to fight his battles for him.

The power of government is now felt more than ever before in the operation of the industry, and it probably will be a still greater force in the future. Good management, successful initiative and economical operation will hereafter count for little as against the great power of practically unrestricted governmental supervision and control. The lessons of the future may be learned from the readable lessons of the past. It is only by cooperative organization that the independents can continue to live.

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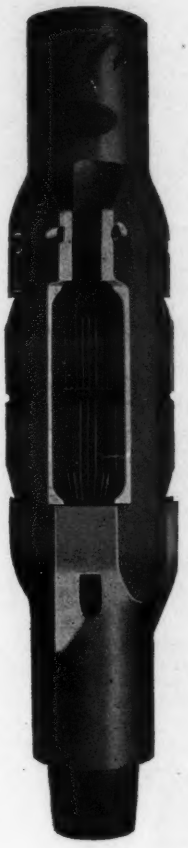
SEATTLE, WASHINGTON

Chiksan

HEAVY DUTY REAMER



This new HEAVY DUTY REAMER is forged of special alloy steel, heat treated. Rollers are unusually long, insuring maximum cutting. Staggered teeth eliminate tracking. It will satisfy your most severe operating requirements.

3-WAY DISC BIT

A rugged, carefully built drilling tool featuring three symmetrically spaced cutters that shear the formation. They do not scrape. Less power to operate therefore easy on drill pipe. The Three Way Bit has proven its superiority. Available in sizes from 5⅝" to 20".

CHIKSAN OIL TOOL CO., LTD.
FULLERTON, CALIFORNIA
Phone 1254

FACTORY, BREA, CALIF.
Phone Brea 199

An Outline Of
26 Years Of Printing Oil News
In California Oil World

Thirty-two pages, 7 in. x 10 in., with cover, three columns to a page, the California Oil World's first issue came from the press at Bakersfield, in August of 1908. Quite different from what it is today! Nothing could be found of more interest to the student of the history of the California oil industry, to the old-timers within its ranks who knew things as they were 26 years ago, or to the newcomer who would learn soemthing of what conditions were in that now remote period.

On the inside front cover there appeared under "Publisher's Statement", the following editorial declaration by the late Chas. P. Fox, founder of the California Oil World:

"There is about the subject of oil that which lends itself to all sorts of petty graft and faking along the lines of publicity. So readily does oil adapt itself to this that The California Oil World has felt that the one obstacle to its success as a distributor of information as accurate as may be, is the suspicion that naturally attaches itself to a new publication having to do with oil matters and oil men. A new oil publication must first prove itself worthy, prove its good faith, prove the sincerity of its expressed determination to record events as they occur and to describe things as they are.

"As proof of the good faith and the sincerity of The California Oil World, it exhibits the advertising columns in this, the first issue. These show that the business men of Bakersfield, where the paper is published, where the project has been most carefully explained, and where the publisher has lived and worked for 15 years, and is best known, have almost unanimously guaranteed, as far as they are able to guarantee any proposition of the future, that the oil public of the state may rely upon this paper to make truthful record of the occurrences which pertain to the oil industry, to the fullest extent that the details of these occurrences are obtainable.

"The California Oil World expects to serve the California oil public along the lines indicated and intends to make itself invaluable to every man interested in oil in whatever capacity.

"Bakersfield has been chosen as the place of publication chiefly for the reason that it is here more than at any other city in the state, that oil news is obtainable. All oil news streams flow through Bakersfield, which is, therefore, the natural headquarters for a paper purposing to render the service this paper has set itself to.

"The subscription price—$1.50 per year, 52 issues—is deemed nominal. Advertising rates are reasonable and fair."

Today, looking over 26 years, the publishers of the California Oil World have every reason to believe that they have made good these promises, especially that the California Oil World has been able to "make itself invaluable to every man interested in oil in whatever capacity".

Perhaps the advertising columns of this first issue, even more than the news, afford an interesting insight into the conditions of that day. On page two, C. N. Johnston, Bakersfield livery stable man, advises oil men that he is prepared to repair their carriages, buggies and other contrivances popular in the days before gasoline drove old Dobbin out of the field. The ad is illustrated by a picture of a runaway being caught and the advice to "save yourself—never mind the carriage" —as Mr. Johnston could fix it as good as new at reasonable cost. On the same page, A. B. Herrington told the world that he was prepared to repair saddles and harness. In the back of the issue the same tale was repeated by other advertisers. On page 26, Ratliff & McGill proclaimed "He Takes No One's Dust whose horses are kept at our stable. They are fed on the best hay and grain, and receive the most careful care from our attendants". C. S. Green says on page 30 that he has a fine livery stable with "good rigs and good horses" at Maricopa. Imagine such advertising nowadays, if you can! Probably this "horse competition in transportation" had some connection with the fact that with an oil supply so comparatively small that it seems funny nowadays, the price of oil was lower than the lowest prices of today.

But as early as 1908, when mules were still used to haul rigs to wildcat drill sites, and when even some oil field superintendents still drove around by horse and buggy, there were the beginnings of the great motor age that made the oil industry what it is today. Our first issue carried three garage ads, and displays of three pioneer auto dealers. One announced the leadership of Buick, another showed a picture of one of the autos of that early date, name not designated, and a third offered cars for either sale or rent. An up-to-date artist said he was prepared to do a good paint job on either an auto or a carriage. Trucks and tractors had not yet come into their own, and one feature ad was that of A. F. Stoner & Co. who sold farm wagons and similar equipment.

"Sports and Auto Notes" was a department of our first issue, for then we had not confined our publication strictly to coverage of the oil industry itself. After all, however, there was considerable appropriateness in this department, especially as to the automobile designed so soon to become the chief support of the industry and foremost consumer of its products, and at the same time a leading part of its own equipment. The situation was well expressed by Mr. Fox, when he wrote in our sports department in the first issue:

"Automobiling is reckoned as a sport almost everywhere else but in the oil fields of Kern county. Here it is regarded as an absolute necessity. But even so, the owners of machines that ply over the steep hills and sandy plains day after day have occasion to derive more than a little pleasure out of the 'speed marvels', for who is the driver who at one time or another has not boasted of busting clear to smithereens this record or that record, and if boasting of shattered records is not underground principle of the automobile game, what's the use of driving a machine anyway?"

When we issued our first number, the agitation for good roads was spreading over the state. Los Angeles county was going particularly strong and Kern county was taking it up. These facts we duly noted, besides telling of the driving exploits of H. H. McClintock, then pipe line superintendent for Standard Oil, and how he drove from Bakersfield to Midway in one hour and 35 minutes, hitting the chuck holes and high spots at 52 miles an hour. Mr. McClintock drove a big Rambler roadster, the Standard's first car in the fields.

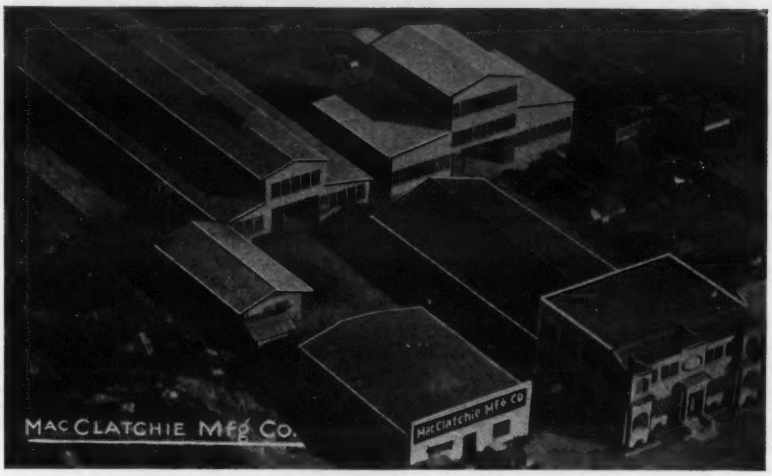
Pioneer Oil Well Supply Houses

But our first advertisers were not all Bakersfield general business men. We had some progressive oil well supply houses in those days, and there were makers of various specialties for oil field use, a number of whom took advantage of the first issue of the organ of the California oil industry to announce their wares. J. F. Lucey had established at Coalinga and Los Angeles the business which later grew to international fame. Oil Well Supply Co. and its California affiliate, R. H. Herron Co., appeared among our first advertisers. Their stores were in Los Angeles, Bakersfield and Coalinga. Fairbanks, Morse & Co. was then a leading oil well supply house and carried an ad in our first issue. Others were: E. A. Hardison Perforating Co., The Brinkman Perforator, and the Bakersfield Hardware Co., the last announcing that it was agent for Nagle Engines and Boilers. F. V. Gordon and G. C. Dennis ran an ad of their oil land and brokerage business.

Our subsequent issues showed great gains in oil well supply house advertising, as the California Oil World became better known through its circulation, spread its new service throughout the state, and was able to solicit business in earnest. Gradually the publication lost its local appearance, ceased to be a Bakersfield journal and became in the fullest sense what it has strived to be, a California oil publication devoted as much to one section as to another and favoring none as against another. The present editor became Los Angeles correspondent with the first issue and continued to serve while retaining other employment until some months later, when a regular office was opened in the southern city with him in charge and giving his entire time to the California Oil World.

News of Oil, Then and Now

Our first news columns also tell an interesting tale. The first item tells of operation in a wildcat field which is still a wildcat, the district between Livermore and Tracy, Alameda and San Joaquin



MacCLATCHIE TOOLS
Lead their field

From a humble beginning in a one car garage the MacClatchie Manufacturing Company has grown consistently until it now occupies a modern plant operating branch stores, its own rubber factory and foundry. We are one of the oldest oil tool concerns adhering strictly to manufacturing and not doing repair work. It has been our policy to develop new and useful equipment and we now have 45 issued patents protecting tools of our manufacture and some 30 patents pending.

We pioneered the cross bar streamline mud pump valve and have manufactured it with practically no change in design over a period of 8 years. It is the largest selling valve in the world. We have also accomplished the feat of having two of our tools (Quick Union and Cement Head) adopted as standard equipment throughout the world. The popularity of our Cement Head has been worldwide. In Russia and Rumania the word Cement Head has been practically dropped from the oil man's vocabulary and is substituted by "McClatch" meaning MacClatchie. In foreign fields especially where operators are so far removed from source of supplies, oil men have learned that they can rely on MacClatchie tools. Many superintendents have told us that when they have needed certain tools which they have not used before they have ordered ours with the thought in mind that they would rather trust a MacClatchie than others as they have learned from experience that MacClatchie equipment is good. Not a month passed during the depression without our making several foreign shipments.

We wish to express our appreciation of the support of our many customers who by their good will, advice and confidence have made possible our present plant and personnel.

Having full faith in the oil industry it has been our policy to continually improve and refine our specialties thereby assuring users of truly modern, scientific equipment. During the past three years we have spent thousands of dollars in developing the following new tools which have recently been put on the market.

"Hydro-Seal" Plug Valves, Pump Liners, Economy Reamers, Drill Pipe and Kelly Packer, Rotating Blowout Preventer, Steel Rotary Hose, Steel Automatic Finger.

MacClatchie Manufacturing Co.

COMPTON CALIFORNIA

XUM

counties, where Horton & Busey, Goldfield millionaires, with W. J. Rhoads in charge, were then trying to get oil, just as many others have tried since, and with equal lack of success. Second came a discussion of oil possibilities on Mono Island in the middle of the lake of the same name situated in the county of the same name. It may be recalled that only some two months ago Los Angeles people made a gesture to drill in Mono county. Following came a story about the Midway Crude Oil Co., founded by a group of field workers and others then engaged in pioneer operations in what is now Midway. The late E. E. Bush, then mayor of Fresno, and some associates had then just acquired 4000 acres at Pt. Arena, Mendocino county, where more than one company has since spent money in a vain search for oil in a district where there are quite a few surface signs to encourage drilling. Now, however, the district appears to be condemned thoroughly by the Sun Oil Co.'s 7000-ft. dry hole put down a few years ago. Claim-jumping was quite active in those early days in the Temblor area. Chanslor-Canfield Midway Oil Co. (C. C. M. O.) was at that time a leader in prospecting in Midway and Temblor but it was not quite the same company as it is today, for that was long before it passed into the hands of the Santa Fe railroad and became its oil department. The company was then owned and controlled by the men whose names it bears and who brought it into existence, viz.: J. A. Chanslor and C. A. Canfield, now both dead. It pioneered the Midway district and was responsible in a greater degree than any other company for the early development of this great district. Years later, Messrs. Chanslor and Canfield sold it to the railroad company whose fuel they had previously been supplying over a long period of years.

Among other stories we carried in our first issue, was one about a huge burning well in the San Geronimo district, 75 miles from Tampico, Mexico. Another told about the use of compressed air for pumping. Ralph Arnold, then with the U. S. Geological Survey, was engaged in mapping the fields south of Coalinga and north of the Kern West Side Fields—Devil's Den, Temblor, North Hills and Carisa.

People interested in Washington's continued efforts to get oil will be interested in our announcement that way back in 1908 Coalinga people had incorporated the West Coast Oil Co. to drill 500 acres of prospective land in Jefferson county, Washington. Officers were: Malcolm Scott, president; Plummer Edwards and R. R. Van Dusen, vice-presidents; B. C. Nelson, secretary; B. E. Montgomery, treasurer. Oil is still being sought in Jefferson county.

J. M. Holloway, remembered by many an oldtimer, had just acquired the Minnehaha Oil Co.'s property, sec. 19, 28-28, Kern River, and was then restoring the three-year old wells to production.

Los Angeles Basin fields were not wholly overlooked in our first issue, although then they were far from having achieved their importance of today. We told about the wildcat activities of the Murphy Oil Co. in the Coyote Hills, where it was then drilling two wells. This property is now the Standard's Murphy Coyote lease, famous for its great productivity. We also told about a pipe line Union Oil Co. was then laying along West 6th Street to connect its wells in the old Salt Lake field with its storage tanks on the east side of Los Angeles. Subsequent issues contained a lot more news about the then limited fields of Los Angeles and Orange counties.

Prominent location was given the story of the controversy then raging among the stockholders of Mt. Diablo, in which the late Dr. A. F. Schafer of Bakersfield had made a number of charges against the company management.

More than a column of our first issue was given to an analysis of a report just made by Union Oil Co., signed by its then vice-president, the late W. L. Stewart. Note that for the first six months of 1908 Union earned $1,560,247.35 net against $2,080,771 for the whole of 1907, and these last earnings were more than double those of 1906. Verily, Union Oil was coming up! Here are its net earnings for six and one-half of its early years as we published them:

1902	$ 299,048
1903	333,387
1904	520,838
1905	1,001,397
1906	1,029,478
1907	2,080,711
1908 (6 mos.)	1,560,247

Union Tool Co. had just instituted action in the U. S. Circuit Court at Los Angeles against Wilson & Willard Manufacturing Co., alleging that the latter had infringed upon the Union's patent in an underreamer. Union's claim rested upon a patent issued in 1901 to Edward Doble, then its president, and the other upon a patent issued to E. Clem Wilson, president of Wilson & Willard. Litigation dragged along for many years and was finally decided by the U. S. Supreme Court in favor of Wilson & Willard. Proceedings attracted wide attention.

Rotary drilling first came to California about the time the California Oil World issued its first number. We discussed at length the rotary drilling operations then being carried on at Salt Lake by the Amalgamated Oil Co., then a subsidiary of the Associated. The Parker rig, an importation from Texas, was being used, and we stated that where it could handle the work at all, it made hole so fast that it made cable tools look sick. However, at that time many doubted whether it would ever be a success in California and there was much stress laid upon the danger of passing through and mudding up oil sands without knowing of their existence. There was no such thing as coring in those days, and for several years the rotary was used almost exclusively in proved fields where location of oil strata was well known. Cable tools continued to be used for wildcatting and for completing wells drilled down to the oil sand with the rotary. Invention and development of the core barrel completely changed the picture and gradually the use of cable tools has almost ceased in California. We should add here, that ere long California banished the Texas equipment and California rotaries have since become famous and are employed all over the world where extremely deep and hard drilling is required.

Coalinga was strongly featured, for it was one of the most important California fields in 1908. Our columns tell of the operations of many companies prominent at that time, some now dead, others still actively producing. Among these companies will be found the following: Zier Oil Co., T. C. Oil Co. (Graham), Lucile, Seneca, S. W. & B., Shreeves, California Diamond, Tavern, Warthan, American Petroleum (C. A. Canfield and E. L. Doheny) merged, after a few years, with Calpet and now a part of The Texas Co., Imperial Oil Co., Section Seven, and California and New York Oil Co.

Such was our first issue. Study of the files shows each issue improved in some way, chiefly in the matter of continual extension of news service.

In November, 1908, the California Oil World changed its form and became an eight-column newspaper. With some variations from time to time to meet temporary conditions it retained this size until its pages were reduced in size and increased in number and the whole improved typographically a few years ago. The present form was finally adopted in September, 1932.

HONOLULU OIL CORPORATION, Ltd.

MATSON BUILDING—215 MARKET STREET

SAN FRANCISCO, CALIFORNIA

Oil Discovered In 1859; Diamond Jubilee In East

Oil was discovered in August, 1859, at only 69 ft., near Titusville, Pennsylvania, by Edward Lamartine Drake. Certainly this strike was the first discovery of commercial importance although it has been said that there was a discovery in Roumania two years before, and oil springs and seepages had been utilized chiefly for medicinal purposes in various parts of the world for ages. However, these prior finds had no effect upon the modern oil industry; that began with Drake.

During the present month this 75th anniversary of the founding of the American and world oil industry is being celebrated at the Eastern Oil Exposition at Titusville.

Discovery of oil brought a rush of wealth seekers. People poured their capital into the new business, wells were sunk rapidly, success crowned many efforts, and then, as at present, the producers soon found themselves overstocked, with no buyers for their wares. Thus came into existence the problem of overproduction which many persons today apparently think is something entirely new.

Just as has been the case ever since, overproduction and surplus stocks created a market. Illumination was the thing the world then called for. Oil supplied it for decades. European shipments began in 1862 and by 1863 were in full swing. People no longer went to bed at dusk or relied upon candles, whale-oil lamps or similar primitive devices. It was a revolution as great as the more recent revolution in transportation made possible by gasoline.

Civil War came only two years after Drake's well came in, but it did not halt the growth of the industry. Prosperity which it gave to business and the resulting revenues to the government no doubt helped the national government during the four years of hostilities, yet its part was almost indirect and comparatively slight. Contemplation of this fact and a comparison of how oil won the World War for the Allies and lost it for the Central Powers should bring to full comprehension the vast growth of oil's part in human affairs. Contrast the Civil War and the World War.

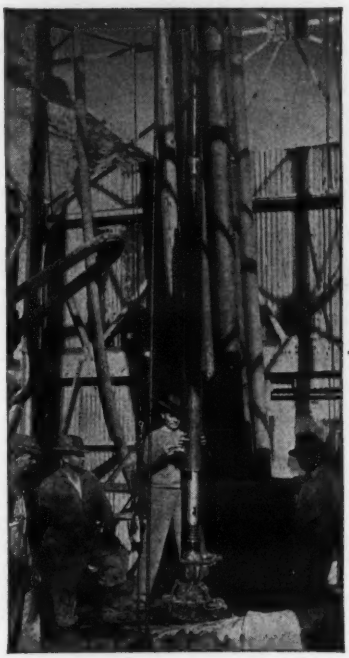
From 1861 to 1865 both armies relied on railroads when they were available, with locomotives fired by coal or wood. When the railroad was not available, soldiers plodded on foot or used horse flesh and the Missouri mule to travel, move artillery, equipment and supplies. When they were able to utilize the rivers, coal or wood fired the old sidewheelers that carried them. At sea, sails were used, steam being introduced during hostilities with coal and wood fuel.

First and foremost among the lessons learned in the World War was the fact that oil was King. When nations now clash let one side be able to get unlimited supplies of oil while the other be short, and the result will then and there be determined. Oil won the war for the Allies and its lack lost the day for the Central Powers. Several years before the first shot was fired, Great Britain had adopted oil fuel for all modern war ships. Presumably because of fear of shortage of supply, for only Roumania and Galicia in Austrian Poland were assured sources for the Central Powers, Germany had clung to coal. The first battle in the North Sea conclusively established the fact that the Kaiser's navy, second only to the British in tonnage, armament and number of ships, with crews equal to the best and officers unexcelled in seamanship and fighting qualities, was practically worthless because of the inferior fuel used.

Use of the submarine depended entirely upon ability to get oil. It could operate with no other fuel. So likewise aviation. On land, abundance of gasoline enabled the Allies to use motor cars and trucks on a huge scale, freed them from complete dependence upon rail transportation. Germans used trucks, too, but not to the same extent and they were forced to build light railways as they advanced to keep up supplies. Tanks had to be operated by oil fuel.

Whenever the world fights again, it will be more dependent than ever upon oil. Germany's efforts to develop a home supply may well be spurred on by the full realization of this fact. Armies will be helpless without motor transportation, and navies that do not burn oil will be worse than worthless. Oil will be an absolute essential alike for the nation that seeks to start a career of world conquest and for the nation that seeks only to defend itself and to be allowed to live in peace.

These facts show how things have changed during the time that has elapsed since Drake's day.



Why guess when you can get the HOLE *story?*

Why *take chances* . . . when the SURWEL Clinograph *takes pictures?* Pictures taken in the drill hole. Pictures that show if you're off the vertical . . . and show the actual direction of the deviation!

Straight holes *save* money. Crooked holes *cost* money. The SURWEL Clinograph will show you how to make these crooked holes . . . *go straight!*

Write for descriptive literature and rates.

Also makers of the SYFO Clinograph.

Sperry-Sun Well Surveying Co.

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402 Petroleum Building

Los Angeles, Calif.
415 Petroleum Securities Bldg.

Tyler, Texas
Peop'es National Bank Bldg.

Houston, Texas
819 Esperson Building

***The* SURWEL Clinograph**

(U. S. Patents 1,124,068, 1,959,141, 1,960,038 and others pending)

Sectional view of a SURWEL Clinograph

CALIFORNIA OIL WORLD

For Twenty-six Years the Authority on the California Oil Fields

Published every Thursday at 702 Transportation Bldg., 122 E. Seventh St., Los Angeles, California
Business and Advertising Offices: Telephone TRinity 3868
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FOUNDED IN 1908 by CHAS. P. FOX

Subscription rate, by the year, $1.00, payable in advance.. In Canada, **$4.25 a year (includes duty). In foreign countries, $2.00 a year. Single copies, 15c. Subscriptions accepted only from persons actively connected with the oil industry.**

Stark Fox, General Manager
M. S. Fox, Secretary
A. R. Hinton, Editor
E. R. Head, Associate Editor
G. S. MacDonell, Advertising Manager
W. B. Keatinge, Circulation Manager

Entered as second class matter, February, 1917, at the Post Office Los Angeles, California, under the Act of March 3, 1879

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Member of the Audit Bureau of Circulations.

DAILY PRODUCTION

California Oil World Estimate

	Week Ended Aug. 18, 1934	Week Ended Aug. 11, 1934	Week Ended Aug. 19, 1933
Long Beach	67,200	68,200	75,900
Santa Fe Springs	41,600	41,500	54,200
Huntington Beach	47,800	46,100	50,750
Seal Beach	9,600	9,350	11,925
Inglewood	10,300	10,450	11,575
Torrance	7,300	7,400	6,550
Dominguez	21,000	19,300	20,600
Rosecrans	3,000	3,100	3,000
Del Rey	8,900	8,750	10,750
Lawndale	150	150	200
Potrero	350	400	300
Los Angeles Basin Totals	**217,200**	**214,700**	**245,750**
Ventura Avenue	27,000	27,500	34,850
Elwood	12,500	12,100	12,700
Rincon	1,600	1,700	1,975
Kettleman Hills	62,000	62,900	59,950
Belridge	7,600	7,200	6,650
Midway-Maricopa	56,500	59,600	47,600
Rest of State	124,000	128,000	96,000
State Totals	**508,400**	**513,700**	**505,475**

A Birthday

WITH this issue, the California Oil World attains an age of twenty-six years. It has probably entered the mind of the reader, long before this page was reached, that something out of the ordinary was in the air. After all, publications don't jump from sixteen pages one week to fifty-six the next without something to account for it.

The California Oil World is twenty-six years old. It has, for all those years, published the news of the California oil industry, never deviating from the one purpose of presenting that news as accurately as it might be presented. The form of the publication has been changed several times—it went from magazine make-up to newspaper make-up, to tabloid make-up, back to magazine make-up—each change being made because it seemed to the publishers that under the conditions then existing, a change in style was indicated, in order that the California Oil World might best fulfill its purpose.

The California Oil World is proud of the fact that on its birthday it was able to publish an issue that contained fifty-six pages. It points to its advertising pages in this issue as the best evidence in the world that the California Oil World actually has what it claims—the united support of the entire California oil industry. Look at the advertising pages—you will find major companies and independents represented there. We submit that when the oil companies themselves spend their money in order that a project of a publisher might be a success, that publisher very definitely enjoys the friendship and goodfellowship of the industry which he is endeavoring to serve.

That the California Oil World is in business at all is pretty good evidence that the oil industry appreciates that it is trying to be of value. That it is of value is evidenced by the support so willingly and freely given by the California oil industry.

The California Oil World enters its next twenty-six years with a great deal of confidence. It feels that the worst of the bad times is over, that the oil industry is very definitely on the mend, and that the future, because of the lessons learned in the past, will be not only better, but better because the oil industry will be a saner, less unbalanced, business, with much less of the "feast-or-famine" element.

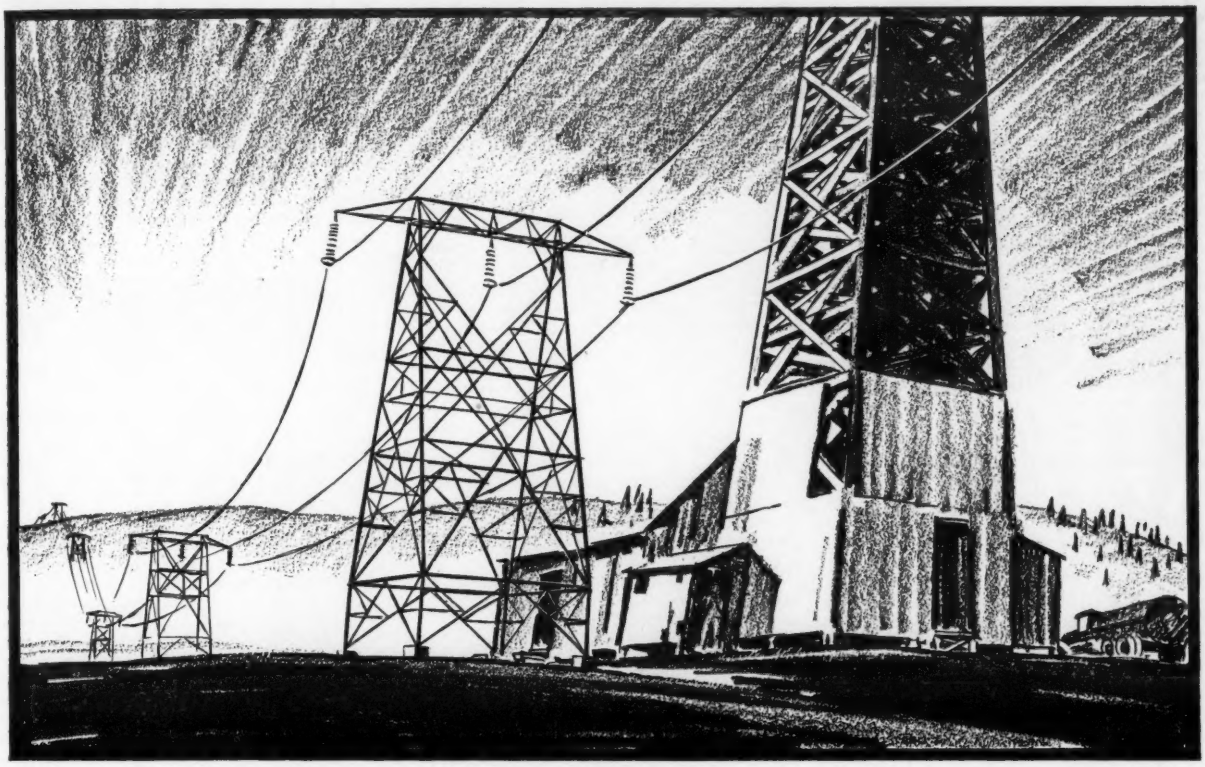
You will note in this issue, along with the review of the industry and sundry other articles regarding the past, several articles of up-to-the-minute value. Those articles—about bottom-hole pressures, well-spacing, curtailment effects—are but a brief taste and forerunner of what you may expect in your future copies of the publication. The California Oil World intends to grow, and it intends to grow by enlarging and increasing its scope of service.

It would be decidedly thoughtless to overlook our regular advertisers at such a time as this. Those are the people that make the California Oil World possible, and to them go our heartfelt thanks. We hope that we shall so conduct ourselves during the next twenty-six years that they will always be with us, knowing that the California Oil World is rendering, and at all times is ready and anxious to render, them service.

A. P. I. Invited

THE American Petroleum Institute has been invited, by directors of the California Oil and Gas Association, to hold its 1935 meeting in California. The directors of the Association have been informed that the local civic bodies will join in the invitation, and that support of all kinds will be forthcoming.

The Institute should meet here in 1935. The directors of the Institute are the caliber of men that will see the obvious advantages of a California meeting, so no further urging will be attempted here, except to say that reasons for holding the meeting here are outlined in the California Oil World editorial of August 16, and it pleases us to know that we again see eye to eye with the industry.



"MARCHING ALONG TOGETHER"

Like two giants sprung from the soil of Southern California, the oil industry and the electrical industry progress side by side.

Mutually serving and protecting the prosperity of the Southland, it is natural that an interdependence and community of interest has grown up.

Electricity serves the oil industry in numerous and vital ways, and takes pride in this service. Southern California Edison lines carry the power for drilling, pumping, lighting and communication to the great productive fields of this area. Edison specialists work in continual cooperation with oil production experts in the selection and installation of efficient equipment.

In turn, the oil industry provides the fuel for the great Edison Steam Generating Works at Long Beach.

The perpetuation and development of both these industries is one of the essential factors in the continued growth of Southern California.

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

Edison

Newport Mesa Next Possibility For Active Development Efforts

With two wells drilling, foundation in for a third, and leasing actively proclaiming possibilities of several other projects to be launched this Fall, hopes of Newport Beach property owners once again have been raised after a long lull in oil activities in the Newport Harbor district.

William Rhoads, of the Pioneer Drilling Co., is convinced that he is on top of the oil sand in the Nuoil well, sec. 29, 6-10, which is drilling at approximately 6500 ft. on the Newport Mesa just off the highway at the entrance to Newport Beach. Oil showings and a heavy gas pressure have been reported. Apparently the real body of oil sand which Rhoads believes will be uncovered has not yet been penetrated, for no effort has been made to halt the drill for a production test.

Piatt and Collins' test of Costa Mesa which lies inland from the Rhoads well, is the second drilling project in the harbor district. This test is in sec. 14, 6-10, and the well is below the 2100-ft. level with possibilities of production at a much shallower depth than will be found on the Newport Mesa.

W. G. Bradford has foundation in for a test of sec. 19, 6-10, but has made no move to proceed.

With encouraging reports from both projects, leasing has become more active both in the Newport Beach and the Costa Mesa districts these last few weeks than at any time in several years. Independent drilling companies are blocking leases. One of them already has signed up a number of parcels of land with a total of nearly 100 acres in the block, but so far as can be ascertained there has been no flurry among the large companies for protection acreage. This lack of interest on the part of the majors is due principally to the failure of early drilling efforts in the Newport Harbor district to show encouraging results. The Interstate Oil Corp., which drilled three or four comparatively shallow tests on the Mesa back of Newport Beach, was responsible for this apathy. Although some oil showings were obtained, none of the wells gave indication of commercial production. But the company retains the leases and all attempts by property owners to regain possession are reported to have been futile. Another reason is the fact that what oil has been obtained at Newport has been very heavy oil. This was demonstrated on the Flats where a small quantity of oil was produced at considerable expense during early drilling.

Grassroots production of heavy oil has been obtained on the Banning ranch, and when the market improves for fuel or road oil, without doubt this property will be developed.

At the moment, chief interest at Newport centers in the Rhoads project. "Bill" Rhoads, who took over the Nuoil lease of the Banning property, is optimistic over showings thus far obtained. He has had plenty of experience, both in wildcatting and development within proved fields. He was the first operator to secure important commercial production on the Santa Barbara Mesa, and the outlook there was no more encouraging when he started than at Newport.

Like most wildcat projects that have reached an interesting stage of development, the usual wall of secrecy surrounds the project, with a "keep out" tag on the gate and a watchman to prevent interested parties from gaining admittance. Mr. Rhoads, however, is frankly optimistic and makes no effort to withhold information from legitimate news sources. He has taken the well down by easy stages and without any serious mishaps of a mechanical nature. Although it still bears the Nuoil name, the Pioneer Drilling Co. is financing the test. There are no outside interests.

The Costa Mesa project is another partnership venture. While primarily it was inspired by gas showings obtained by Collins in the shallow test he drilled in 1919, later and more effective showings are reported to have been obtained in the Waterman well located about a mile southwest of the present drilling well. Work on the Waterman well was suspended and no effort has since been made to deepen this test.

Should either or both of these projects obtain commercial production, a lively drilling campaign would ensue. Lease terms in part, if not all of the leases signed, call for drilling within 90 days and this means that drilling will go forward at Costa Mesa, where geologists have gone over the district and have expressed the view that a well defined pool exists.

Half-Year Reports Show Improvement

Analysis of reports for the first six months of 1934 reveals a healthier statistical position for the oil industry than during any similar period since 1930. Operations in the industry were on a more profitable basis despite increased labor costs under the oil code.

Demand for petroleum products was steadily higher, reaching a peak total for any similar period since 1930. Total demand (U. S. Bureau of Mines) for all oil amounted to 504,083,000 bbls., as compared with 461,930,000 bbls. for the same period of 1933, an increase of 42,153,000 bbls., or 9.1%.

Posted crude prices during the first half of the year remained unchanged at an average of $1 a barrel for 27 gravity in California and 36 gravity in the Mid-Continent. This is in sharp contrast to first half year prices a year ago, particularly in East Texas where in May prices dropped as low as 10c a barrel, and 36 gravity Mid-Continent crude to 25c a barrel. Dollar crude in the fields of the Southwest did not come until late in the third quarter of last year, but there was an improvement in refined products near the end of May which resulted in advances for crude oil in June. At the close of that month, 36-gravity crude in Mid-Continent fields was posted at 44c a barrel and East Texas at 50c. Prospects of crude curtailment and price fixing aided in further stiffening crude prices during the third quarter of 1933. During the second half, companies with large supplies of crude and crude products purchased at low prices during the first half of the year, reaped full benefit of improved price schedules. The smaller units, primarily producing companies, were benefited from the advances for crude, with the result that earnings for the industry as a whole advanced sharply during the second half of the year, enabling the majority of companies to offset losses of the first half, and to show fair profits on operations for the year.

California Production 508,400 Bbls. Per Day

California crude production followed an erratic course during the week ended Aug. 18, with a total daily average for the week estimated at 508,400 bbls. This compares with 513,700 bbls. for the previous week—a decline of 5300 bbls. However, official figures revealed a total daily output as of Aug. 16 of 521,000 bbls., and 506,000 for the previous day. With such a disparity in daily output and no particular reason to account for it save the erratic day-to-day conduct of certain of the unlisted fields, the estimate for the week is considered conservative.

A year ago the state averaged 505,475 bbls.

Los Angeles Basin totaled 217,200 bbls. for the week, an increase of 2500 daily. Midway-Maricopa, off 2100 bbls., and the unlisted fields down 4000, were the only important changes.

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Application Of Graduated Curtailment Method Like Income Tax

By H. W. Lee and Wm. Hight

Application of the graduated method of production allocation as used in California is a matter of considerable debate and interest at the present time. In short, the principle involved is that while curtailment is necessary throughout the state to stabilize the oil industry, the greatest degree of curtailment should be borne by the flush or larger wells with a lessening burden assessed as the wells decrease. In effect, the graduated method is nothing more nor less than the application of the principle that the larger the well the greater is its percentage of curtailment. Just as the income tax is a levy on net revenue, so in reality curtailment is a tax on production. The minimum allotment per well, based on the effective depth, is an allowance or credit given every well capable of receiving it, which corresponds with exemption features in the income tax principle.

The present form of graduated curtailment combined with the minimum allotment feature has eliminated many of the "special allotments" previously granted to smaller wells and to those with abnormally high water content. On the straight percentage method it became necessary for field committees to permit certain "specials" in order to allow wells of this type to continue operation without economic loss.

There are at least four factors that should receive consideration for allocation purposes, either individually or collectively. These are: estimated recoverable reserves; proved acreage; number of producing wells; potential production. For all practical purposes, estimated reserves may be disregarded as a usable factor for allocation. Likewise, it is a very difficult problem to give weight to the proven acreage factor without causing much debate and dissension. There are, then, but two of the original four factors for allocation left, namely: the number of producing wells and the potential production, of which even the latter factor is often a much discussed subject. Despite this fact, the potential factor is at least an indication of the amount of oil recoverable.

The somewhat unethical policy of obtaining forced or abnormal potentials over a short period as typical of the sustained capacity of the well to produce over longer periods of time, is discouraged by the present graduated method. The allotment of each well is determined by assigning a fractional power to its recognized remaining potential, but inasmuch as a corresponding increase in the potential does not result in a corresponding increase in the allotment, the incentive for the abnormally high potential of a well is at least palliated.

The graduated method was first applied primarily to adjust potentials of wells of the type just described. A small well normally capable of producing 100 B/D, might be forced to produce 110 B/D, a little over 10% increase, but a 500 B/D well might easily be increased to 800 B/D, or even more, for a period of time. The application of the decimal factor of graduation tends to adjust these potentials to a point where the rate of decline for both wells is approximately the same. Plate I shows the production graph of a small well with a potential of about 200 B/D and the slight increase when placed on a potential test in comparison with a larger well with a normal potential of about 650 B/D that will exhibit a "proration" potential of 885 B/D and thus secure an overrating of over 25% on the basis of a short-time test.

It might be well to show an individual example of the mechanics of the present graduated system. From the "effective potential" of the well is subtracted the "minimum allotment" (one barrel per 200 ft. of producing depth) and the remainder is termed the "remaining potential". The fractional or decimal power or "factor" assigned to the "remaining potential" results in the "remaining allotment". The "remaining allotment" plus the "minimum allotment" then equals the "base quota" of the well. This base quota is subsequently corrected for consumptive market demand and its proportional share of the production advances or balances against the pool and the final result is the "producible allotment."

For instance, the allotment of an individual well on the .80 power with an effective potential of 500 B/D producing from a depth of 5000 ft. would be calculated as follows:

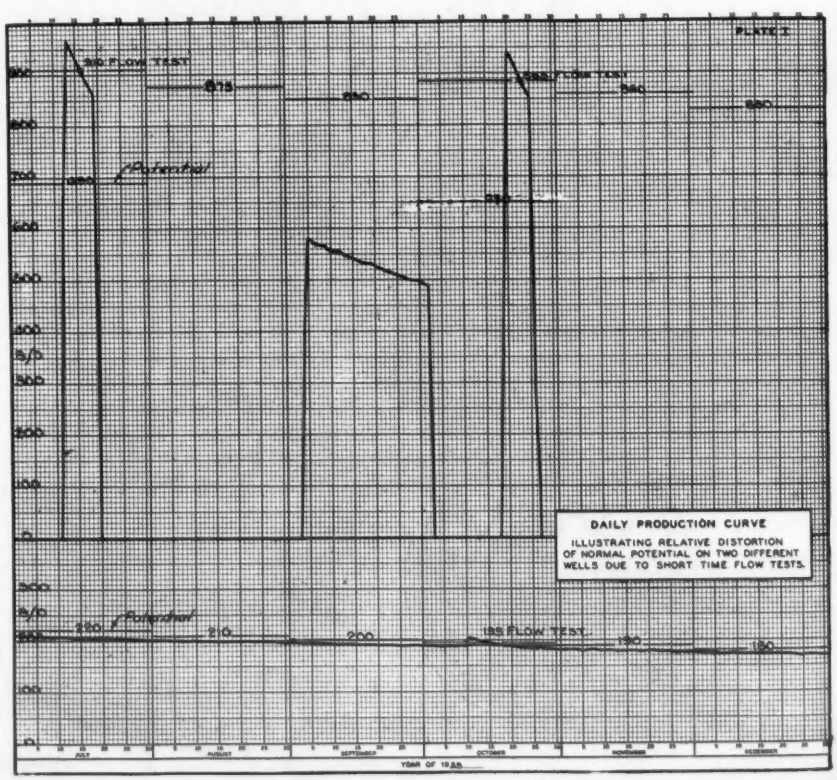
500 B/D Effective Potential
−25 B/D Minimum Allotment
475 B/D Remaining Potential

$(475)^{.80}$ =

138 B/D Remaining Allotment
+25 B/D Minimum Allotment
163 B/D Base Quota

The minimum allotment, as noted above, is exempted from the graduation and is designed in part to offset the lifting cost of the well although the latter is not directly proportional with depth.

The following tabulation of 10 wells of the same depth but with potentials ranging from 30 B/D to 2000 B/D and the respective allotments for several methods of curtailment shows the resulting effect on the various wells:



Well No.	Potential B/D	Minimum Allotment B/D	Remaining Potential B/D	(A) Remaining Allotment B/D	(A) Base Quota B/D	(B) Remain ng Allotment B/D	(B) Base Quota B/D	(C) Base Quota B/D
1	2,000	25	1,975	434	459	498	523	571
2	1,450	25	1,425	334	359	360	385	414
3	900	25	875	227	252	221	246	257
4	500	25	475	138	163	120	145	143
5	350	25	325	102	127	82	107	100
6	180	25	155	57	82	39	64	52
7	100	25	75	32	57	19	44	29
8	50	25	25	13	38	6	31	14
9	40	25	15	9	34	4	29	11
10	30	25	5	4	29	1	26	9
	5,600	250	5,350	1,350	1,600	1,350	1,600	1,600

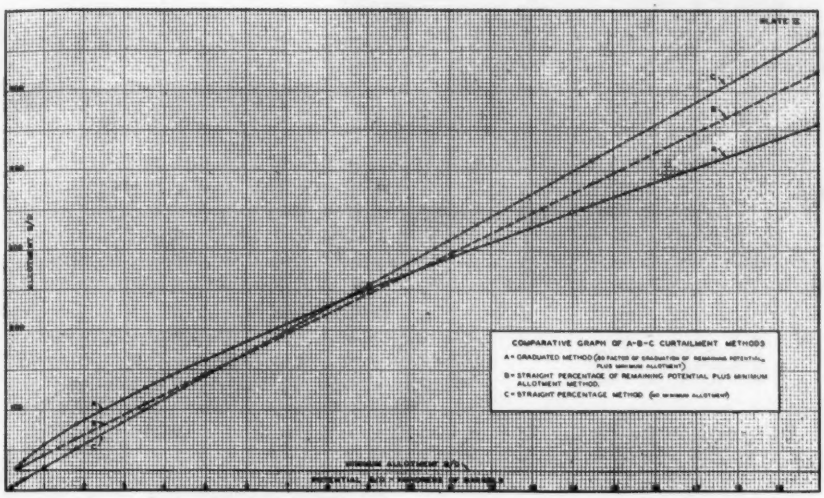


PLATE II
COMPARATIVE GRAPH OF A-B-C CURTAILMENT METHODS
A= GRADUATED METHOD
B= STRAIGHT PERCENTAGE OF REMAINING POTENTIAL PLUS MINIMUM ALLOTMENT METHOD.
C= STRAIGHT PERCENTAGE METHOD

The wells listed above are assumed to be producing from a depth of 5000 ft., which, on the basis of one barrel per 200 ft. of producing depth, allows 25 B/D as a minimum allotment. In the above tabulation, case "A" shows the results of decimal graduation of the .80 power combined with the minimum allotment feature; case "B" the results with the straight percentage method also combined with the minimum allotment feature and case "C" shows only the straight percentage method without the minimum allotment. It will be noted that the potential of the wells listed is 5600 B/D and the allotment under each system of curtailment totals the same, 1600 B/D. From the above, the previous discussion regarding the more severe curtailment on the larger wells and the lesser curtailment on the smaller wells is exemplified. Plate II shows graphically the results of the above tabulation.

It is very difficult, in fact impossible, to satisfy all operators, but experience has shown since the graduated method has been in effect, that the basic principles, such as depth allowance and the decimal factor of graduation, are eminently fair and reasonable, in that the method is uniform as between fields with no special privileges granted to any.

The fairness of the system may be debated in the case of a property that is less fully developed and with correspondingly larger wells than adjacent fully developed properties with relatively smaller wells, because the larger wells under the graduated method are required to curtail a greater percentage. This situation is unfortunate and indicates that possible abnormal drainage is being incurred from the less developed property by the preponderance of adjacent closely drilled properties. For intra-field allocation, the features of a modified graduated method might be a more equitable solution of this type of problem. This situation under normal conditions without curtailment would be met by further development along unprotected property lines and, to a degree, seems the only logical thing to do under curtailment.

The whole spirit of curtailment, aside from the economic and stabilizing features, is that if the oil industry is to prosper and eventually recover the maximum amount of oil, it is necessary to lighten the burden on the small or edge wells, not only that they may pay out but that they may recover all the available oil possible. Much of this oil would be economically unrecoverable if small wells were compelled to share an equal percentage of curtailment with the larger wells, due to possible water infiltration and more particularly because it would be, in many fields, financially impossible to operate this type of well.

Oil Producers Sales Agency Founded To Help Stabilize Industry

By Rush M. Blodget

Man's ingenuity had, for the first time in history, enabled production to catch up with and definitely exceed demand. Man's task was no longer to "speed up"; his task had resolved itself into an effort to slow down the whirring buzz of production, without destroying individual units of industry.

The group which formed Oil Producers Sales Agency was the first natural resource group of any magnitude to recognize that the solution lay in co-operation

Oil Producers Sales Agency of California is in its fourth year. It was organized on the call of Ralph B. Lloyd, now its president, to give independent oil operators an opportunity to do their part in stabilizing the oil industry and the shock of the depression.

When it was organized, industry in general was just beginning to realize that a great and possibly permanent economic change was taking place in America—and in the entire world.

—that one for all meant service; that all for one meant servitude; while all for all meant cooperation.

Thus, the Agency was founded on co-operation. Every man in the original group knew in his inner consciousness that he had reached and held his place through the cooperation of others—through helping hands, seen or unseen. None felt so godlike that he needed no help, none so hardy as to refuse it, and none so selfish as to accept it without reciprocation.

And the Agency itself, as an entity, could not have succeeded without the cooperation of the entire industry. That help, even if only given in expressions of appreciation, is gratefully acknowledged.

Since its formation, the Agency has labored conscientiously to help the industry. It has contributed its time and effort to every movement that might bring and maintain stabilization. It has endeavored to make each and every unit of the industry conscious of every other unit, of their duty to each other, to their employees and to the public.

It has labored not from sentiment—and not by compulsion—but out of a broad intelligence that sees the normally selfish value of mutual reciprocation.

The Agency sincerely believes in co-operation, and therefore in the right of industry to govern itself, subject always to those proper regulatory laws which protect labor and the public and foster the public peace, health, and safety.

The Agency has acquiesced in the de facto legality of paramount law, as expressed in temporary legislation and codes. But it has always kept faith in the industrial men of California, and expressed its opposition to any attempt at permanent bureaucratic control.

It has never tried to be popular, but has always tried to command respect. It has never sought credit for the work it has done. It has tried to lift—and not to lean. It has never asked for special assessments. It has helped members and non-members alike.

If any unit of the oil industry shall propose any sound program that will help the industry, its employees or the public in relation thereto, the Agency stands ready to help.

XUM

Agency Directors Protest Wage Order

The board of directors of the Oil Producers Sales Agency has filed formal protest by wire with Oil Administrator Ickes against his order of May 21 relative to wage schedules and differentials, with particular emphasis on the retroactive pay clause. The purpose, as explained in the resolutions passed by the board, is to bring to the attention of the Administrator the inequities to California operators and employees created by this order.

The retroactive clause was fully discussed at an open hearing by the Labor Board committee which was to file its report with the Administrative Board at Washington. Secretary Ickes, therefore, with receipt of the Agency telegram, will have a complete picture of the California situation as it reflects the attitude both of employees and employers.

In its message, the Agency board states that without waiving the legal rights of the Agency or of members of the board of directors, it hereby protests said order on the following grounds:

1. That it violates the provisions of the National Industrial Recovery Act and of the code by setting up a method of fixing wage schedules and differentials different from the method provided in the act and code.

2. That by the use of the percentage method cumulated into retroactive pay, it confirms presumptively incorrect schedules and differentials.

3. That it thus confirms—where they exist—unfair competitive wage scales, between companies.

4. That in the application of the time factors with the percentage methods it in many cases dislocates established fair differentials heretofore existing within companies.

5. That by such dislocation it sets the men against each other and against the employer and gives rise to discontent.

6. That it ignores the earnest efforts of the California industry in preparing and submitting prior to Sept. 2, 1933, wage schedules and differentials adapted to California conditions.

7. That it presupposes that the California industry has not treated its labor fairly, and notwithstanding the cordial relations heretofore created and maintained in California between oil workers and employers by ordering retroactive pay, it creates in the mind of many of the employees the impression that they have been underpaid.

8. That it does not correct any inequities, but in reality causes many inequities between the men, between companies, and between the companies and employees.

9. That the order fixes wages and orders retroactive pay without regard to the ability of the producer of oil in California to pay.

Copies of this protest signed by Ralph B. Lloyd, president; R. A. Broomfield, vice president, and C. C. Spicer, secretary, were transmittted to Petroleum Administrator Ickes, to the Planning and Coordination Committee and to the Regional Committee of the Sixth District.

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Venice Last Field Of Townlot Development Characteristics In California

By E. R. Head

Venice was the straw that broke the camel's back! It was oil development in this closely populated residential district, and the resultant animosities engendered —inspired primarily by a publicity barrage directed against tideland and beach drilling—which concentrated in an attack out of which came legislative action in 1931. A law was passed prohibiting townlot drilling for oil within 150 ft. of any property line within city limits of the state.

Thus, a phase of California oil development, with its good points as well as its abuses, was effectively eliminated. Townlot drilling in a large measure was responsible for the amazing growth and development and the undreamed of wealth it brought to California. The abundance of refinable oil which poured from the simultaneous drilling of the three big fields of Los Angeles Basin—Long Beach, Santa Fe Springs and Huntington Beach —supplied the need for high grade gasoline for motor fuel and at prices which popularized motoring. Cheaper gasoline and cheaper cars were the net result. Los Angeles Basin townlot drilling, therefore, was indirectly responsible for bringing gasoline within the reach of the poor man's pocket, and helped to put the whole nation on wheels.

From an industry standpoint its benefits are admitted. First, through the marketing division which opened the gates to world trade. Second, through crude recovery, for it has been proved(and disproved) that a greater recovery of oil per acre was obtained by close and rapid drilling of these fields, with a correspondingly larger financial return to landowners and lessors than is possible under the present deliberate organized development of new fields, as approved by the federal government.

At the time of this intensive drilling of the big fields of the Basin, demand for refinable crude was imperative. The World War was ended. A new age—the Motor Age—had dawned. To meet these demands, sacrifices were inevitable. Such demand does not exist today and there is no legitimate reason for overproduction of refinable crude such as since has been witnessed. In this urge, however, rests what justification can be found for depleted gas zones and the loss of this valuable natural resource through lack of pipeline facilities and a market. It already had performed its initial service—that of lifting the oil to the surface, yet it is unfortunate that millions of feet of gas were dispersed—blown to the air—and never can be recovered.

Aside from the "blow," tremendous losses were incurred through fires which ate heavily into revenues as they added additional hazard to the drilling—one of the most serious menaces directly traceable to townlot drilling. They called attention to such hazards, however, and resulted in the introduction of safety first measures in California oil fields now comparable with those of any other industry.

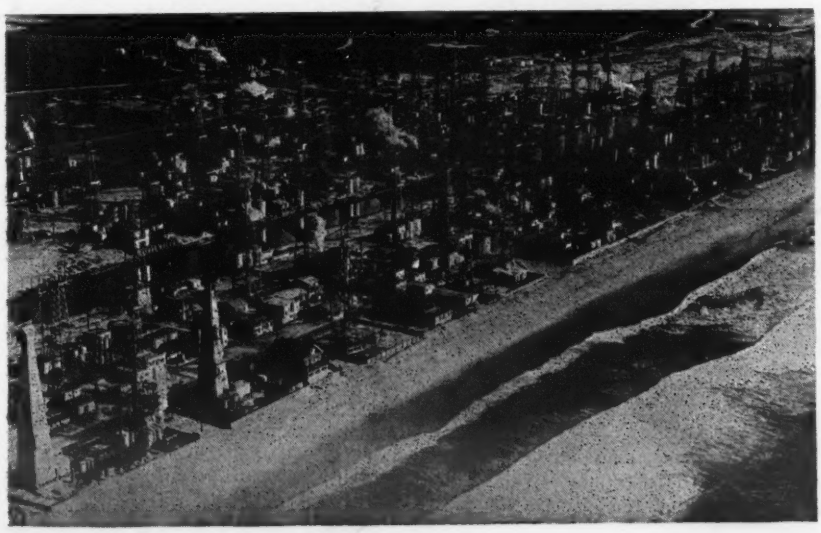
Townlot drilling brought thousands of visitors to California. The majority of them became residents. Other thousands obtained employment in the fields, the plants or company offices. And so business generally, as well as other industries on the coast, reaped benefits.

But trade expansion was the vital result. While the big influx of light oil eventually brought its own penalty in a weakened price structure, California refinable crude reached out to all quarters of the world on the popularity wave which followed other Basin field discoveries—six in all, including: Rosecrans, Inglewood, Torrance, Dominguez, Seal Beach and Playa del Rey. With the exception of Dominguez, each has dedicated a portion of its history to close drilling. During the lull which followed these discoveries, efforts were made to correct some of the abuses which had been the natural outgrowth of such haste and some progress was made, particularly in a "clean-up" of unhealthy promotion activities. Then came another wave of drilling resulting from the discovery of deeper productive zones in Long Beach and Santa Fe Springs. About the same time—the autumn of 1928—Kettleman Hills burst into the limelight. This complication brought results out of which were evolved California's voluntary curtailment efforts and the crystallization of a program of more orderly development of new fields. Operators likewise have developed a saner view toward the industry and toward each other, together with a broader understanding and appreciation of results achieved through cooperative effort.

Very little of this philosophy was apparent during the early days when townlot drilling had its first inception in the old Los Angeles City pool. This field was bounded by what is now the Baker Iron Works on North Broadway and curved west and southwest to the present site of Westlake Park.

The City field gradually disappeared, not because of lack of oil nor because the wells did not pay. Geologists claim that a big undeveloped pool of light oil underlies Los Angeles. Yet elimination of the field was inevitable. Increased real estate values and the march of business and residential sections crowded out the derricks. Today only a remnant of small pumpers linger as monuments to the enterprise of such industry giants as E. L. Doheny, C. A. Canfield and J. A. Chanslor, whose names are synonymous with California oil development.

Playa del Rey, the Venice sector which climaxed the townlot drilling phase, offers one of the anomalies of Los Angeles Basin. It is unique in that it bears no relationship to any other Basin field, and that the Venice section lies within the Los Angeles city limits. Three companies, Ohio Oil which discovered del Rey, Union Oil and Barnsdall Oil Co., control the acreage which produced the bulk of the 25,889,980 bbls. of oil recovered from the field (as of June 30, 1934). The Venice townlot sector rose to prominence and literally passed out of the picture within a year of intensive drilling. Its passing probably left a larger number of receiverships to the square foot than any similar district in the state. With the exception



Playa del Rey

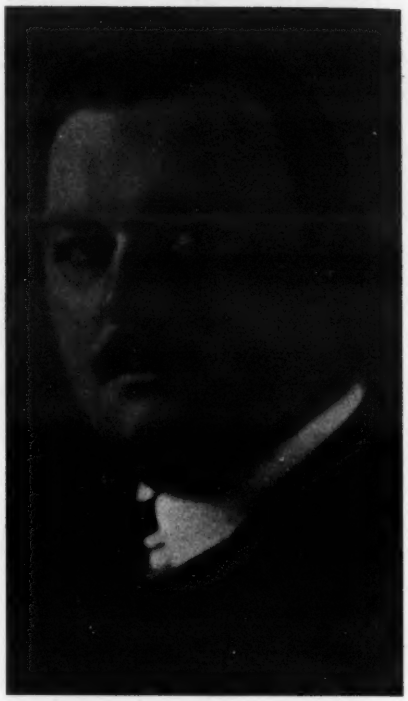
Activities Of California Oil And Gas Association Numerous

By Charles S. Jones, President

Before 1910, it was the Los Angeles Chamber of Mines; now it is the California Oil and Gas Association. The background of that change is the ever-increasing importance of oil and the static position of mining. But in 1906, when the organization was founded, mining was much the more important.

The old Hollenbeck Hotel, which until recent years stood at the corner of Second and Spring Streets, was the birthplace of the California Oil and Gas Association. There congregated mining men —promoters, prospectors, and operators— with tales of new strikes, of new hopes, of failures. The idea of a permanent organization, builded on the informal foundations that theretofore had sufficed, was suggested.

The result was the Los Angeles Chamber of Mines, of which John R. Mathews was the first president. Its announced purpose was to develop the mining industry of the great southwest and to assist Los Angeles to assume its proper place as the center of the minig region comprising southern California, Nevada, southern Utah, Arizona, and New Mexico, as well as the northern states of the Republic of Mexico. Fred A. Hines and Rol King were the organization's first vice-presidents. Among its earliest directors were E. W. Gilmore, Seeley W. Mudd, C. E. McStay, J. Ross Clark, George H. Mosher, C. M. Shannon, E. W. Gillett, Calvert Wilson, and Orra E. Monnette.



Charles S. Jones

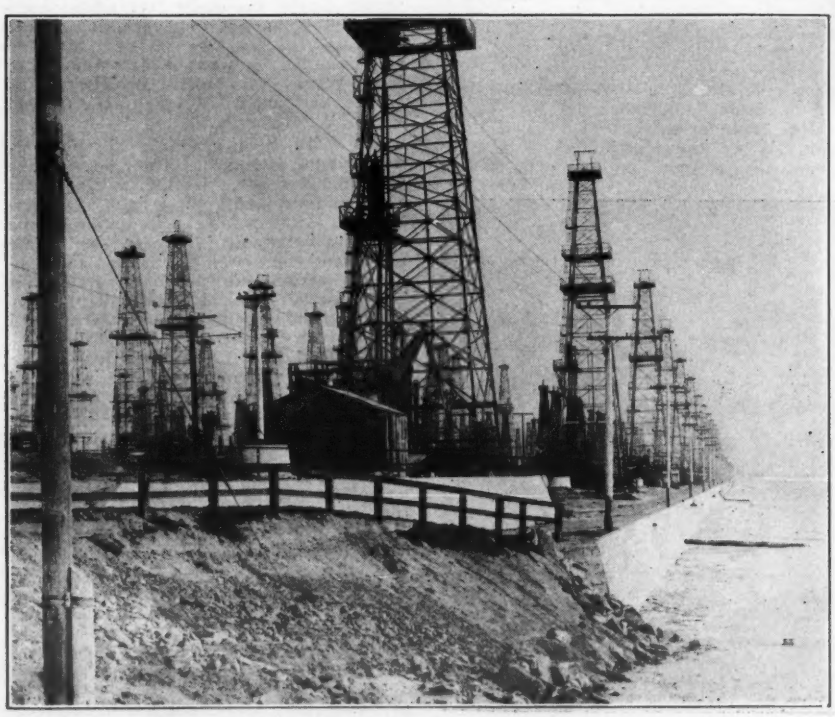
In strong contrast to the dominating role oil has since assumed is the restricted one it played in the early days of the organization, but in 1910 its advance was recognized in the change in name from the Chamber of Mines to the Chamber of Mines and Oil. Then, in 1929, so slim in proportion to the growing oil membership had the mining segment become, the name was changed to the California Oil and Gas Association, and its mining interests were abandoned.

The prominence that the Association enjoys today is the culmination of a spurt of renewed activity that began in 1925 and has accelerated with each passing year. But the mainspring of that activity is the confidence that the industry (because the Association has endeavored to embody the best thought of the industry in every crisis) places in the Association. One of the most effective features of the organization is its flexibility. Since it represents about 80 per cent of the potential production of California, the Association is ready for all emergencies. As the

of two or three experienced independent companies, which gained early entrance to the Venice beach strip, very few if any of the operators made any money, and the great majority finished in the red. This was equally true of property owners who had given up their beach homes in return for those elusive income for life promises.

Yet analysis of the Playa del Rey situation reveals that perhaps 60 per cent of the difficulties which followed were due to the time the field was discovered (Aug. 2, 1929). The country already was surfeited with oil. Overproduction of light oil, rather than any other cause, went far toward ruining the hopes of Venice operators, landowners and investors. Caught in the big squeeze of deep zone drilling at Santa Fe Springs and Long Beach, with Kettleman Hills just over the horizon, the industry was literally swamped and markets were glutted. Venice paid the price.

The California oil industry set to work to dig itself out of the impasse caused by townlot drilling. More stringent field protective measures against fire hazard, plans for orderly development of new fields and new deep zones, and the law of 1931 which prohibits townlot drilling were the results.



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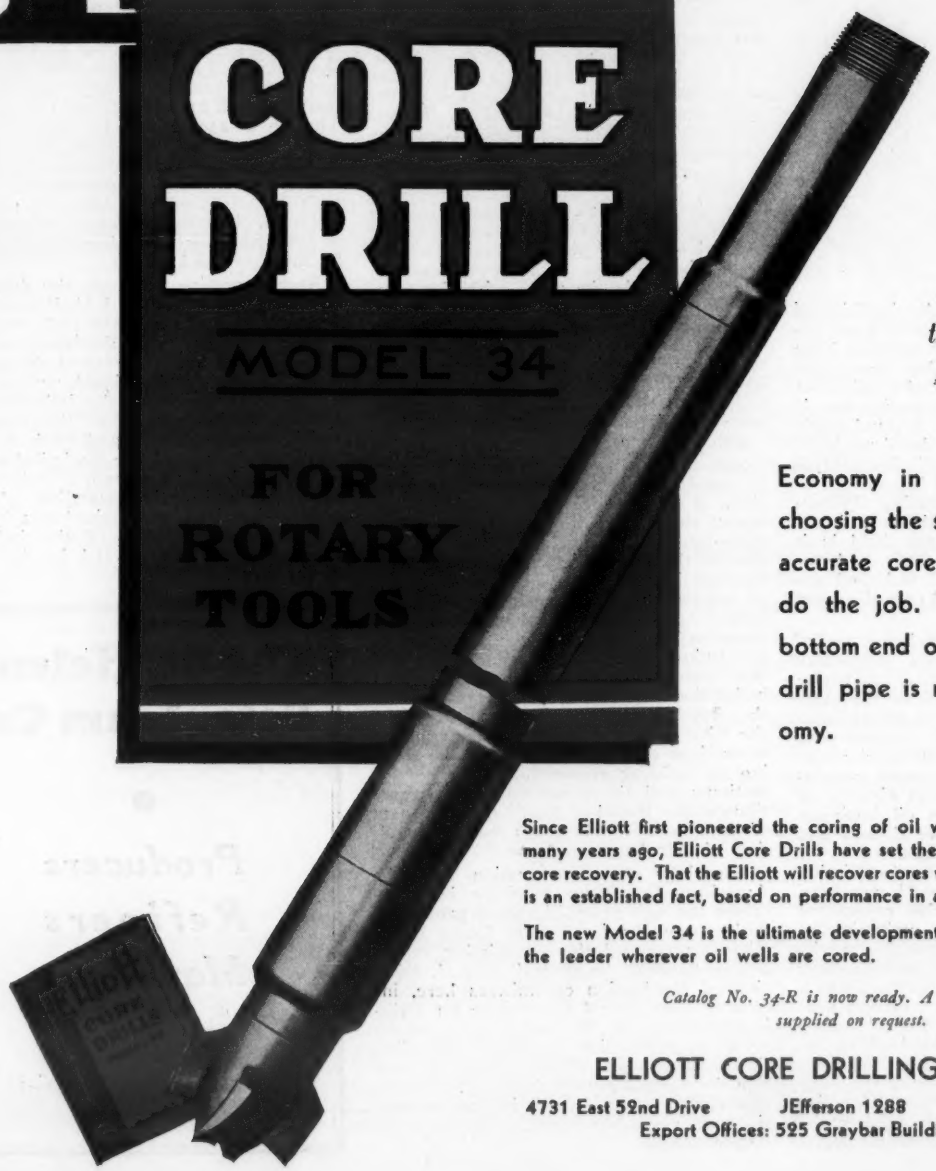

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problems of the industry have changed with the years, the activities of the Association have changed with them. Its story is always the story of the industries it represents.

Task of Association

Broadly speaking, however, the task of the Association is but one: to provide a means for cooperation within the industry and between the industry and the various city, county, state, and Federal bodies, as well as the general public. All its individual projects are but parts of that main task. That this task has, on the whole, been successful is by the good health enjoyed by the organization today.

The breadth of its influence is indicated by the diversified character of its membership. Nearly every operator of importance in the state is included. Among those holding individual memberships are prominent attorneys, engineers of all classes, bankers, and manufacturing and supply firms. And what do these members hope to obtain through their membership? The answer lies in the purposes of the organization, as enumerated in its by-laws:

"To promote and foster, through cooperative effort, the interests of all branches of California's oil industry. To provide a forum for the discussion of matters of general interest to its members. To promote cooperation between California's oil industry and Federal, state, and other governmental agencies. To promote better understanding between this Association and other similar state and national organizations. To provide means for the study of the arts and sciences involved in the conduct of the oil business."

To realize these ideals, the facilities of the organization have gradually been expanded. Successively larger quarters have been secured, the library has been augmented, and the mechanical equipment has been improved. The present plant is adequate to care for every demand made upon it. Its location, in the Associated Realty Building, 510 West Sixth Street, is convenient, and among its features it includes an assembly room seating 150 persons. The popularity of this room is attested by the many meetings, held in it every month, meetings not only of Association committees, but of technical societies and various other oil organizations.

Classes of Memberships

Memberships in the Association are of two classes, sustaining and individual. Sustaining members, including practically all the important producers of the state and many of the smaller operators, contribute to the Association in proportion to their production of oil. Individual members, embracing those persons or corporations (except oil companies) directly or indirectly interested in the oil business, pay an initiation fee of five dollars and quarterly dues of three dollars.

The governing body of the Association consists of a directorate of 23 members, which embraces an executive committee of five members. There is maintained a total of 20 standing and special committees, chief among which are the following:

The Public Relations Committee, which is charged with the duty of studying proposed legislation affecting the oil industry and other matters of a kindred nature. The Standardization Committee, embracing 10 sub-committees, covering the various items of oil field equipment. The Fire Protection Committee, with subcommittees in the various fields and with a legislative committee. The Safety Committee, including legislative subcommittees.

The most important activities of the Association center in the work of the Public Relations Committee. Cooperation is maintained with national and local governmental bodies, chambers of commerce, and the various state institutions with which the industry comes in contact. Proposed state legislation and city and county ordinances are closely studied, and opposition is presented to those which appear to be inimical to the industry and to the public. Every effort is made to secure prompt and reliable information regarding movements of questionable benefit to the industry. Through the cooperation of members and committeemen and through other sources, the Association is kept well informed of such developments.

Fire Protection

The Fire Protection Committee's most ambitious project is to organize the fire-fighting facilities of the oil companies and the railroads in the Los Angeles Basin. Its 230-page book, containing lists of equipment owned by the member companies, the location of such equipment, the names, the addresses, and the telephone number of those in charge of the equipment, maps of the various districts included, and data relative to assistance obtainable from the railroad companies, is brought up-to-date periodically. As part of its activities the Committee is endeavoring to obtain master maps of every community in the Los Angeles Basin through which oil pipe lines run, on these maps the location of lines and valves, and then to file the maps with the communities. In furtherance of the work, the Committee this last year worked with the Los Angeles County Fire Department to draw up a model county fire ordinance, and with the councils of several southern California cities in drawing up model municipal fire ordinances.

Other activities of the Fire Protection Committee this year included an attempt, in cooperation with the State Fire Marshal, to standardize the threads in fire hose; the completion of recommendations on proposed electrical safety orders of the California Industrial Accident Commission; the completion of a system of regulations for the safe handling of butane and other liquefied petroleum gases, regulations that were submitted to the Industrial Accident Commission and later were issued as safety orders by that body; the preparation, in cooperation with the Building and Safety Department of the City of Los Angeles, of amendments to sections of Ordinance No. 28,700 relating to building requirements for service stations; and the preparation of suggestions to the Board of Port Commissioners of the City of Stockton for the safe handling of petroleum products.

Especially close cooperation with the American Petroleum Institute is maintained through providing the organization with space for its Pacific Coast office. The secretary of the Association serves as secretary of the several A. P. I. Division of Production committees here, including the Topical Committee on Drilling Practice, the Topical Committee on Production Practice, and all standardization committees. Three of the Association directors serve on the A. P. I. directorate, and other Association representatives occupy other high positions in Institute affairs.

The Association also provides office space and facilities for the California Natural Gasoline Association, and provides certain facilities for the Southern California and Southern Nevada State Petroleum Committee on the Pacific Coast Petroleum Industries Committee. Still other organizations using the Association's facilities from time to time include the Kettleman North Dome Association, the Middle Dome Corp., the American Institute of Mining and Metallurgical Engineers, the Central Committee of California Oil Producers, the Petroleum Equipment and Suppliers Association, and the Regional Refining Committee.

The most spectacular function of the Association is its Annual Banquet, attended in some years by as many as 1400 oil men. It is the California industry's principal opportunity for getting together on a light-hearted basis, and no oil man willingly misses it. The crowd looks forward with particular eagerness to the annual Wildcat play, which satirizes the foibles of the industry during the preceding 12 months, and never yet has it been disappointed.

The Wildcat Committee is known as the industry's fountainhead of good will and entertainment. The play at the Annual Banquet has already been mentioned. Though this production provides the Committee the opportunity for its most spectacular work, a schedule of other activities, including golf tournaments, barbeques, and frequent business meetings, is followed. Interest in their sporting events is stimulated by several trophies, put up by members and others.

Among routine activities, the Summary of News and Events of California's Oil Industry, issued monthly and circulated among members and subscribers, records in tabloid form the events of the month, both California and national, and presents a statistical review of the industry's activities, a bibliography of the magazine articles of the month, and book reviews. A valued feature of the statistical review is the gauging by a system of index numbers of the monthly standing of each product itemized. Recognized as a barometer of the condition of the industry, these numbers are quoted in the press of the state.

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Establishing Of
Kettleman North Dome Association
Bulwarks Curtailment

Kettleman North Dome Association, organized at the request of the Interior Department following the discovery of Kettleman Hills in October, 1928, has been the cornerstone of California curtailment. The outstanding service rendered to the industry by Kenda was the prevention of wholesale overproduction and its inevitable price collapse during the period which immediately followed the discovery of Kettleman Hills, and later—East Texas. This service cost Kettleman operators generally, and those bound by their pledge to the Kenda agreement in particular, unprecedented sacrifices.

Out of these sacrifices, however, has been evolved a series of plans for the orderly development of new fields and new zones which has laid a firm foundation for controlled drilling and curtailed production in California and elsewhere. Without the Kenda unit plan—William Reinhardt, general manager of Kenda, reported at the Kenda Advisory Board hearing—it was easily conceivable that Kettleman Hills production would have averaged 750,000 bbls. a day from the 150 wells (made necessary by offset drilling) with but an average output of 5000 bbls. Thus, the deluge of oil which later poured out of East Texas because of the lack of a controlled development plan, might conceivably have been duplicated in California during 1929, at a time when deep zone development at Santa Fe Springs and Long Beach reached its peak.

The Kenda unit plan, while far from satisfactory, has served as a basic pattern. Its adoption—under urgent pleas of federal authorities—set up the machinery for the first organized drilling program of its kind. The government, as one of the principal landowners, served as the "back pressure" which placed it in execution and maintained it under threat of revocation of permits and refusal to grant extensions. Had the government, through authority vested in the then Interior Secretary, Ray Lyman Wilbur, pursued a more liberal and less dictatorial policy during the formative period of this experiment in orderly development of large acreage, it is conceivable that the unit plan in a modified form might have been acceptable to other fields. The only plan approximating its terms is the Middle Dome program patterned after but modified in certain particulars. Its adoption in the Middle Dome was compulsory, for, as in the North Dome, the government is the "landlord" and wields powerful influence over a large portion of the permits.

Curtailment under the unit plan has been maintained by Kettleman operators on a basis in strict conformity with their agreement—but not without considerable internal strife. This has been due to the intensive development of competitive fee acreage adjoining Kenda and Standard Oil holdings. The unit plan admittedly has resulted in a larger recovery of crude under economies of operation impossible in individual company operation. It is currently estimated that as a result, ultimate recovery from Kettleman reserves of 21,200 acres (within the proved limits) will average 100,000 bbls. per acre—a conservative estimate.

Natural gas recovery—because of its uncertain quantity—would be more difficult to estimate, but all are agreed that one of the greatest benefits derived from the Kettleman discovery was the placing of this big volume of natural gas at the disposal of northern California consumers. The gas cap from which the bulk of the highly prolific natural gas is obtained is limited in the area on top of the North Dome. The first four wells drilled produced from the upper Temblor in this zone, but with the discovery by Superior Oil Co. of the valuable black oil zone in the bottom Temblor, conservation meas-

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ures were put into effect to protect the gas zone. There have been repeated rumors of "depleted gas zones" and "water intrusion" at Kettleman North Dome but these have been disproved except on the outer edges, which is typical of all oil field development.

Complaints over inequities which have arisen under competitive drilling, induced by development of fee holdings and the inevitable protective offsets, finally culminated in the appointment last March by the Central Committee of an Advisory Board to hold open hearings to give Kettleman operators, landowners and royalty holders an opportunity to discuss their grievances, and the murky atmosphere was somewhat clarified.

This hearing, it developed, was one of the most beneficial in the state's history. It not only proved a safety valve for pent-up complaints, but it added to the valuable data already compiled and submitted to the board. After careful consideration of the written complaints and plans submitted, the Advisory Board recommended a solution which its members deemed to be more equitable allocation of crude quotas. This recommendation—known as the volumetric withdrawal formula—was accepted by the Central body and since has been used in determining Kettleman allocations.

Most of the arguments over Kettleman allotments had rested on demands by Kenda and Standard for allocations on an acreage basis, or the volume of content bounded by property lines. Fee land operators relied on the "right of capture" clause and held out for the per well allotment plus percentage of potentials. The volumetric withdrawal formula appears to be the nearest approach to a satisfactory conclusion of these arguments. It does not prove entirely satisfactory to the companies which complained of drainage from competitive offsetting.

At one point in the record appears this statement:—" a small operator in California always has had a recognized advantage over the large tract owner, due to ability to drill up faster and secure a greater percentage of flush oil." That about sums up the situation.

In this respect it is interesting to note that Superior Oil Co. has just completed the last of its eight-well program (one well to 20 acres) on the famous Huffman 160-acre lease in the northwest quarter of 29-J, from which in excess of 7,000,000 bbls. of oil have been recovered. As a result of the new allocation method and recommendations by the board—that companies offering objections should avail themselves of the same opportunity by speeding up their drilling programs—Union-Amerada (on the King lease), Standard and Kenda all have increased their drilling. Union-Amerada controls one quarter section and Standard the other two in sec. 29-J—and at the rate of Superior Oil's recovery—44,528 bbls. per acre, this one section would produce in excess of 174,000 blbs. per acre.

Mr. Reinhardt, in his presentation of Kenda's side before the board, observed that if Standard and Kenda properties in the Huffman area were developed to the same degree, there would be a potential variously estimated from 1,500,000 to 2,000,000 bbls. "Obviously, conditions in the state under which we are producing simply won't stand for such a picture at the present time." However, I think that it doesn't require much imagination to foresee what would have happened to California curtailment had the Standard and Kenda followed that procedure.

"We have been penalized in the past," he concluded, "by what has been termed our failure to develop our properties. The fact that this failure has perhaps saved the oil industry of the state has been given no consideration. If, then, the Standard and Kenda are faced with the choice between developing their properties aggressively, or continuing to suffer the drainage of their reserves as in the past, I have no doubt what the decision will be."

Other benefits accruing from the Kenda program at Kettleman Hills and the development of the North Dome field have been the steady work given to a large number of field men at better wages than obtainable in many other fields; the increased demand for equipment for drilling, gas and oil pipelines laid to the sea and to the north to connect with Bay district mains and for field gathering lines, and likewise for absorption plants. This development inspired deep drilling on parallel structures, and throughout the Valley, resulting in the development of new deep zones and additional drilling activity which is expected to continue.

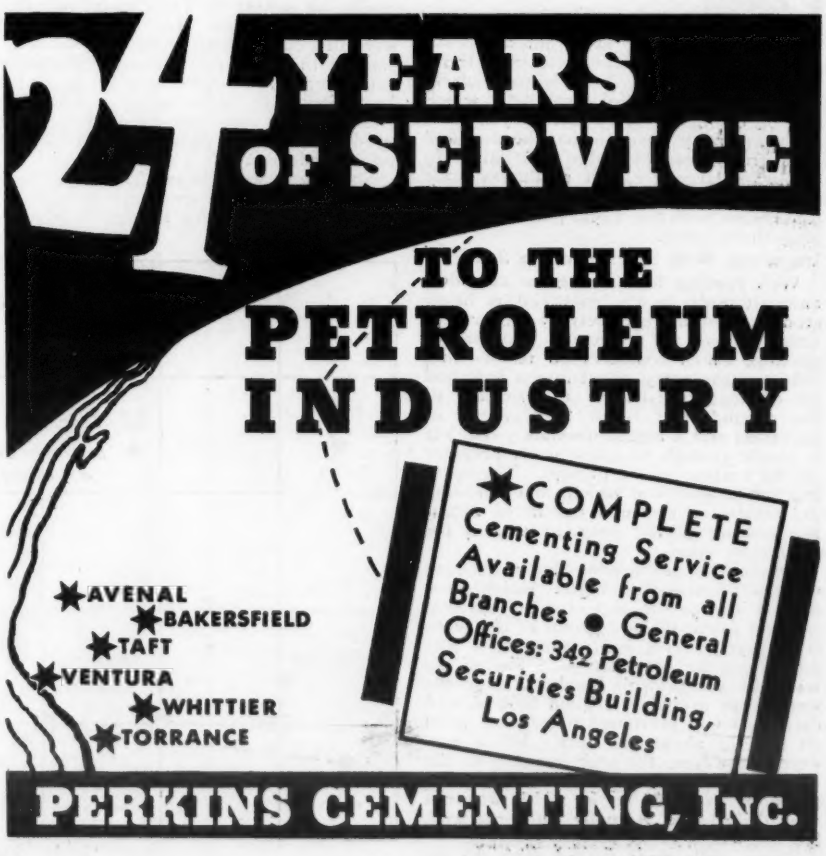
While Kenda members in the past have not benefited as much as others, future drilling of Kenda reserves is expected to increase output in proportion as the smaller holdings decline, provided the gas horizons are not disproportionately depleted through drainage from competitive development.

One of the aftermaths of this important discovery was the litigation directed against land and lease holders, with the government joining in the legal battles for increased royalties. Some of these suits are still pending and probably will be for some time to come. They have added immeasurably to costs for leaseholders and landowners. Not the least of these has grown out of the so-called imaginary lines encompassing the twilight, or semiproved zone, and the consequent shrinkage of acreage originally included between the blue and red lines as field limits have been defined. Decision of the engineers' committee early this year resulted in a suit by the Armstrong property owners against Kenda for failure to drill more tests of this twilight zone.

An interesting "exhibit" prepared and placed in the Advisory Board record by a representative of one of the large companies shows the acreage percentage of members in this so-called twilight zone. It reveals quite a shrinkage, particularly in the southeasterly sector of the field. The table is appended:

KETTLEMAN NORTH DOME ASSOCIATION ACREAGE PERCENTAGES OF MEMBERS

Member	Within Blue Line	Within Brown Line	Within Purple Line (Latest Percentage)
General Pet.	23.1	23.8	24.4
Milham Explor.	18.3	18.7	20.3
Continental Oil	18.3	19.2	19.9
Pac. West. (K. O.)	13.3	13.8	15.0
Shell Oil Co.	9.2	8.5	6.8
Union Oil Co.	5.2	4.6	3.6
Associated Oil	2.3	2.3	2.3
Pioneer Kettle.	1.9	1.8	1.7
Belmont Invest.	2.3	2.1	1.7
Pet. Securities	1.8	1.6	1.6
Standard Oil	1.8	1.5	1.4
Amerada Pet.	0.9	0.8	0.5
Helm & Gillan	1.1	0.7	0.4
Total	100.0	100.0	100.0



Underground Surveys Enable Corrective Work To Be Done

Underground surveying of oil wells has now become a definite department of good drilling practice. But it was not until Alexander Anderson made the first underground survey of an oil well in California in 1924 that the inclination and direction which a well took in reaching its objective was accurately measured and plotted. While many operators had begun to suspect that their wells were not maintaining a vertical direction throughout their course, it was only by means of the survey methods thus introduced that any definite knowledge as to how much or where they were wandering was ascertained.

The information secured from surveys naturally led to the serious consideration of means for drilling straight holes. This has resulted in a conscientious effort by operators to keep their wells vertical, and in the further development of instruments to aid them in doing this. It is becoming more generally the practice for operators to survey their wells for both inclination and direction at periodic intervals during the drilling of the hole, and in this way any corrections can be made before the hole gets so far from its vertical course that straightening will be expensive.

Surveys of old wells have disclosed not only interesting facts but also conditions that are far different from those thought to obtain. This is particularly true in regard to geological data, which can be erroneous in an unsurveyed well. In very many cases it has been found that groups of old wells have failed to penetrate large areas of producing zone although their surface locations had been established with the direct purpose of tapping those areas.

Important Well Spacing at the Sand

Well spacing has been given considerable attention in the past and is being studied even more closely at the present time. There is no doubt that proper spacing, which considers all factors that influence the entry of oil into a hole and its efficient transfer to the surface of the ground, will result in economy of operation and a higher ultimate yield. Yet it is not enough to space wells properly on the surface of the ground. The spacing that counts, and which alone can bring the results so carefully calculated for, is the spacing of the holes at and in the productive zone.

The effect on spacing by wandering wells is illustrated in Fig. 1, which gives a good idea of the sort of condition that is often found when a group of old wells is surveyed. This figure presents a true picture of the condition in a line of six wells in a California field. All of the wells were drilled to around 6000 ft. and each well was presumed to produce from an area of about one acre. When surveyed, however, the true location of the wells on the sand was disclosed and a space of over 800 ft. in width was not even drilled into. Actually, only one well, No. 10, was near its surface location.

These wells were spaced with the intention of drilling one well in approximately each acre. The horizontal distance at which the wells finished from the surface locations varies from 75 ft. for No. 10 to 650 ft. for No. 14.

The greatest value of the surveys of these particular wells lay in the information gained for corrective work. Not only could the geological data be corrected to provide a means for an intelligent drilling campaign for the entire lease, but from the information secured, the area that it had been the original intention to drill up could be tapped by vertical wells put down from suitable locations.

Any investigation of irregularity of production can readily be explained in a case like this by putting down a well between No. 14 and No. 15. A decided saving of money is indicated by avoiding the drilling of a well north of the derrick location of No. 14 since No. 13 is seen to bottom almost immediately under that location.

Variation in Production

Wells that are seemingly located in highly productive areas sometimes do not come up to expectations when their production is compared with that of surrounding wells. The surface location may really be good; in most cases of this kind it usually is. But the wells may have drifted down structure and the location at the sand may be in a very poor producing area. The reverse has also been found to occur when a well has wandered up structure to make a good producer in the midst of surrounding poor producers.

Sometimes wells in good locations even miss the structure entirely. A case of very steep dips. As shown in Fig. 2, this kind happened in a structure with

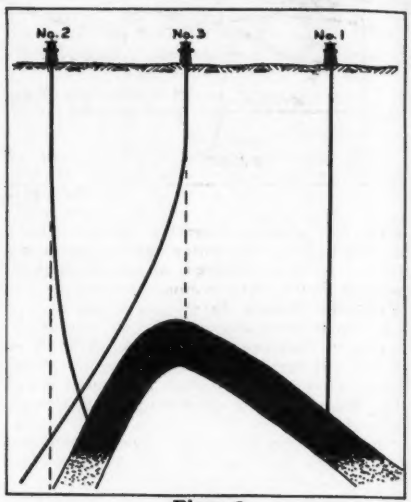


Figure2

well No. 1 was drilled and completed with very satisfactory production. Well No. 2 was then drilled by another operator and was equally good. Well No. 3 was therefore drilled between them with every assurance that it would probably be a better well than either of the other two.

The assumption was correct; but the well did not prove it. Drilling was finally stopped since the sand was not even picked up after a considerably greater depth was reached than in the other two wells. Both operators then had their wells surveyed. Well No. 1 penetrated the sand about where it should have.

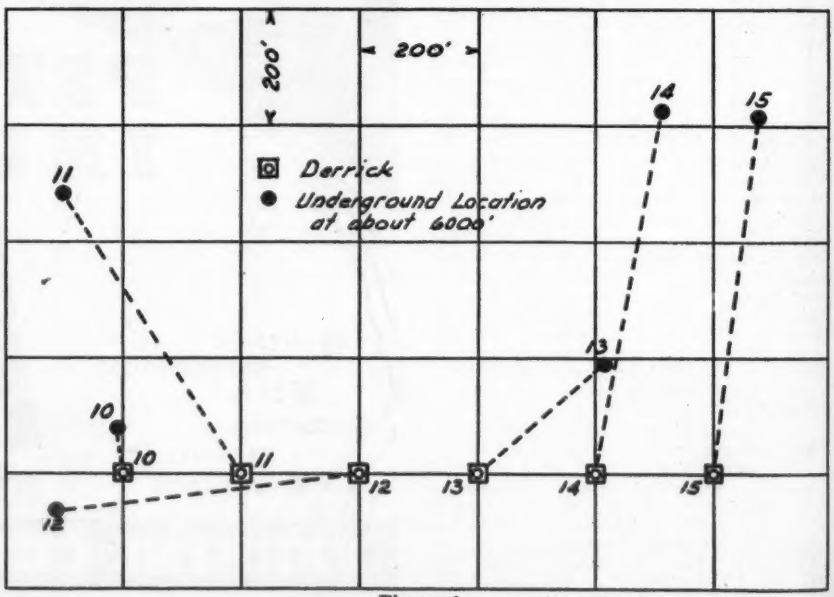


Figure 1

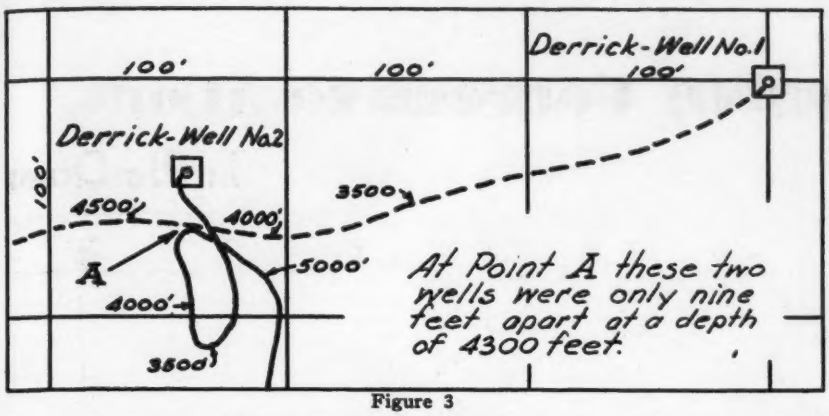


Figure 3

Well No. 2 should never have touched the sand above the water bearing horizon. And No. 3, if drilled straight, should have been the best producer.

Wells Sometimes Meet

Underground surveying has probably advanced more rapidly in California than in any other oil producing territory in the world. The method for measuring the direction and inclination of a well was invented and developed here and over 10,000,000 ft. of hole have been surveyed in this state by the oriented survey method alone.

The accuracy of underground surveys is now rather well recognized. As an example of how unusual conditions check survey data, however, Fig. 3 is given to illustrate a case in a California oilfield.

The two wells shown were drilled by different operators at locations 245 ft. apart on the surface. Both wells were surveyed to depths below 5000 ft. during the course of drilling. Shortly after the surveys were made, however, and while both were still drilling, circulation from one started to pass into the other. Upon investigation, it was found that this intercommunication had occurred at a depth of about 4300 ft. The two surveys were then plotted on the same sheet—and showed the wells to be only nine feet apart at 4300 ft.

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Federal control of the oil industry under the NRA became effective Sept. 8, 1933, with the petroleum code the accepted and approved "by-laws and constitution" under the new set-up. Oil Administrator Ickes and members of his Petroleum Advisory Board have been the directing heads of the industry with similar divisional set-ups throughout the country cooperating.

As the first year of federal control nears its end, a check-up of results is illuminating. While actual achievements, perhaps, have not quite come up to expectations, those accomplishments recorded have been well worth while. Chief among them from an industry standpoint has been the curb placed on hot oil production. There remains room for improvement along these lines but a big step forward has been taken with the net result that there is today a greater degree of stability than seemed possible a year ago.

California's outstanding contribution not alone to the oil industry but to industry in general, has been the launching of the marketing agreement and its operating arm, the Pacific Coast Petroleum Agency. This agreement which was evolved from the ill-fated cartel plan introduced last fall, marks an important stride in the direction of cooperative movements—an exepriment in which marketers and refiners, large and small, for the first time have entered into agreement in an attempt to balance supply and demand in the common interest of business in general.

To the surprise of many—and the chagrin of a few—the experiment is progressing satisfactorily. It got off to a bad start—caught in the pincers of the harbor strikes—but weathered the storm and is on its way. There are some complaints, principally from the small group of "chiselers" whose price-cutting tactics have been a constant source of trouble to the marketing division. Their profits, obtained at the expense of hundreds of the smaller dealers, have been reduced, but the so-called "little fellows" are still doing business and in most cases making a decent living. Retail price advances for gasoline have been on a moderate scale—not as much as some marketers desired but sufficient to place the division on a more profitable basis. The Agency takes over any excess crude or gasoline from its members and supplies the same from the pool in the event there is a shortage. While it is too early to make a forecast at the moment its outlook is promising although Coast refiners have been upset by the screws recently applied to gasoline production by the Petroleum Administrative Board.

Likewise there has been some disturbance in the production division of the Pacific Coast, largely through what one of the Administrator's representatives terms a misinterpretation of the Ickes order of July 26 wherein the Administrator reaffirmed the method of graduated curtailment. This method has been in effect since July 1, and the order, it was said, merely restates a program worked out, first by the code and allocation committee and accepted by the Central Committee, in an effort to bring about a unification, and therefore a more equitable allocation of crude quotas.

From the date of its approval, it was recognized that readjustments would be necessary. As this representative explained, it would be impossible to impose an iron-clad rule on the industry. The Ickes order remains in effect "until modified by me," but modifications appear to be near at hand—for the September allocation is now under discussion.

Fears expressed by some operators that the Central Committee had committed itself to bureaucratic domination in Washington were declared to be equally groundless. Neither Mr. Ickes nor his advisors, it was explained, have any desire to dictate policies inimical to the good of the industry. The order was but a restatement of a policy already put into effect by the Central Committee to make it effective when and if possible in other producing sectors. It in no way supplants the code, nor abrogates nor abridges the authority of the committee. There is an amicable understanding between the Committee members and the Washington authorities which future experience, it was said, will justify.

Much of this misunderstanding is attributable to the failure of the California code to receive federal approval. However, it was learned, the chief obstacle to such approval lies in the fact that it failed to secure the complete support of the industry, which was essential. Only a comparatively few companies actually attached their signatures to the code.

When one recalls the chaotic conditions of a year ago which threatened—through unrestrained development of the East Texas field—to glut the market with crude and cause a complete collapse of prices throughout the country, there is reason to believe that real progress has been made. The measures adopted may not always have met with approval but they have effected a more reasonable amount of curtailment. This is particularly true in the East Texas field where a plan similar to the one now in effect in California has been introduced with some success. Excess crude and gasoline are purchased and taken off of the market by various companies under agreement similar in some respects to the California marketing agreement. Only through these outlets, it should be remembered, has real progress been made toward supporting price structures.

This first year of federal control as an emergency measure has been a strenuous one with experiments and adjustments, changes and counter moves. Ideas of regional groups have not always meshed with those of the governing body. But the industry set itself to the task of ironing out misunderstandings, of allaying suspicions and eliminating cross purposes.

The objective was to achieve a greater degree of stabilization, which coincided with the purposes of the Administration. With this factor as a common denominator, disturbing problems gradually have been clarified and a few of them have been solved.

At least, the year closes with a better understanding, a closer spirit of harmony throughout the industry, a keener appreciation of the benefits derived through the various cooperative efforts put forth, and a nearer approach toward the goal.

Woodward Makes Test

Down some 5400 ft., Woodward Oil Co. is taking a formation test. There is strong gas in sand and shale. Trouble in setting the packer was causing a little delay at last reports. The well is the Western Ave. wildcat now attracting so much attention.

Petrol Plans Edison Well

Petrol Co. is preparing to drill its first well on the Edison structure. Its location is on sec. 35, 30-29, offsetting Ohio's Cauley No. 1, sec. 36, immediately to the east. These two wells will be the southeastern outposts of the field.

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Discovered In 1876, Pico Canyon First Oil Field In California

California's first commercial oil was discovered in 1876 in Pico Canyon, Newhall, Los Angeles county, by the California Star Oil Co., headed by D. G. Scofield, a San Francisco dealer in paints, kerosene and similar articles. The Pacific Coast Oil Co. was incorporated in 1879, with Mr. Scofield as president, and absorbed the California Star, acquired fee title to some 5000 acres at Newhall, drilled a series of wells, piped the oil to the coast, built a refinery at Alameda, and worked up a trade in Northern California. Standard contracted to buy all its refined products in 1890 and in 1900 bought out its entire capital stock, making that company its production, field and pipe line department. When the old Standard combine was dissolved in 1911, Pacific Coast Oil Co. changed its name to Standard Oil Co. of California, and took over all Standard's Pacific Coast business and properties. Mr. Scofield remained with Standard as vice-president and general manager until 1911, when he became president.

Prior to 1876, California is credited with having produced a total of 175,000 bbls. A small discovery was made in 1866 at Petrolia, Humboldt county, from which small quantities of oil were shipped to San Francisco, but the well soon ran dry. Some oil was produced in Colusa county and several other places, but data are uncertain.

From Newhall, prospecting for and discovery of oil pushed west across Ventura county as far as the Santa Paula district. Lyman Stewart, who became first president of Union Oil Co., pioneered this region, and founded the Hardison-Stewart Oil Co., out of which grew the Union Oil Co.

Down to Dec. 31, 1933, Newhall-Ventura county, not including Ventura Avenue, produced 51,097,172 bbls. Prior to 1894, when the Los Angeles City field was brought in commercially, Newhall-Ventura county was the only California source of commercial oil. Statistically, Los Angeles and Salt Lake are grouped and down to Dec. 31, 1933, had produced a total of 64,267,997 bbls.

Down to Dec. 31, 1933, California produced a total of 4,076,508,019 bbls. of oil. Since the bringing in of Drake's well in 1859 the entire United States has produced, down to Dec. 31, 1933, a total of 14,071,624,000 bbls., of which total California's contribution came to 28.95%. When it is noted that as late as 1900 the state's production totaled only 4,319,950 bbls. and amounted to only 6.79% of the national total to the same date, some idea will be obtained as to the growth of the industry here since the beginning of the century.

Dates of discoveries of the California fields, other than those already covered, their initial recorded annual yield, and total to date, follow:

1894—**Summerland,** the state's first tideland oil field, produced 1800 bbls., during 1895 this increased to 16,000, and to Dec. 31, 1933, the field totaled 3,072,038 bbls.

1896—**Coalinga,** opened by Chanslor & Canfield's Blue Goose well, sec. 20, 19-15, Oil City pool, good for 300 bbls. daily, 890 ft. Production of field for 1896, 14,119; 1897, 70,140 bbls.; peak 19,546,112 bbls. during 1912; total to Dec. 31, 1933, 327,-207,346 bbls.

1898—**McKittrick,** first year 10,000 bbls.; peak 1909, 5,807,360 bbls.; 1933, 651,361 bbls.; total to Dec. 31, 1933, 82,-679,238 bbls.

1898—**Fullerton,** first year's production 12,000 bbls. peak 1914, 6,495,100 bbls.; 1933, 2,964,674 bbls.; total to Dec. 31, 1933, 146,841,489 bbls.

1900—**Kern River,** first year 826,775 bbls.; peak 1904, 17,226,240 bbls., (down to Dec. 31, 1902, the state's entire production was only 14,356,910 bbls.); 1933, 3,210,010 bbls.; total to Dec. 31, 1933, 292,973,866 bbls. Actual discovery June, 1899, by Jonathan and James Elwood, 320 ft., 20 bbls. per day.

1900—**Midway-Sunset** (first appearance statistically), first year 12,000 bbls.; peak 1914, 50,025,843 bbls.; 1933, 17,541,812 bbls.; total to Dec. 31, 1933, 747,204,308 bbls. Sunset area was discovered by Jewett & Blodget about 1894, the main Midway May 1, 1901, by Producers Guaranty Oil Co. with a 250-bbl. well at 1407 ft.

1902—**Santa Maria,** first year 94,188 bbls.; peak 1908, 8,699,350 bbls.; 1933, 1,254,818 bbls.; total to Dec. 31, 1933, 129,599,624 bbls. Discoverer main field, Western Union Oil Co., Careaga No. 2 well, 2150 ft. deep, production not available. **Discoverer of Cat Canyon, Palmer Oil Co.** (E. E. "Zeke" Henderson, president and manager).

1910—**Lost Hills-Belridge,** first year 4,900 bbls.; peak 1917, 6,359,421 bbls.; 1933, 3,205,873 bbls.; total to Dec. 31, 1933, 71,132,282 bbls. Lost Hills was discovered by Dudley & Martin of Visalia, at 472 ft. First discovery at North Belridge was by Mannell-Minor Co. in 1911, depth 3025 ft. Deeper zone was found by Belridge Oil Co. at 5457 ft., 2640 bbls., Oct. 7, 1930, and South Belridge by Belridge Oil Co. April 6, 1911, 575 ft., 100 bbls.

1912—**Whittier** (first separate statistics, previously grouped with Fullerton), first year 747,439 bbls.; peak 1917, 1,156,752 bbls.; 1933, 404,128 bbls.; total to Dec. 31, 1933, 15,892,130 bbls. Discovered 1898 by Whittier Crude Oil Co. (Chas. F. Off et al). Rideout Heights section discovered 1901.

1917—**Montebello,** first year 789,635 bbls., peak 1919, 12,100,784 bbls.; 1933, 1,933,121 bbls.; total to Dec. 31, 1933, 92,056,913 bbls. Discoverer, Standard Oil Co.

1912—**Coyotes,** first year 1,359,303 bbls.; peak 1918, 12,614,598 bbls.; 1933, 3,698,372 bbls.; total to Dec. 31, 1933, 135,383,461 bbls. Discoverer, West Coyotes, Murphy Oil Co., 1909, but no statistics were issued until 1912 because of a long series of trouble with water which kept the oil off markets. Discoverer East Coyotes, Amalgamated Oil Co. (Associated), Mar. 25, 1911, 3353 ft., 600 bbls. 18 gravity, Anaheim Union Water Co. well No. 1.

1916—**Ventura Avenue,** first year 2650 bbls.; peak 1929, 20,934,388 bbls.; 1933, 12,576,208 bbls.; total to Dec. 31, 1933, 142,361,394 bbls. Discoverer, E. J. Miley (State Oil Co.)

1919—**Elk Hills,** first year 281,019 bbls.; peak 1921, 18,085,425 bbls.; 1933, 4,423,-512 bbls.; total to Dec. 31, 1933, 128,617,-928 bbls. Discoverer, Standard Oil Co., whose work put the field on commercial basis; however, Associated Oil Co. is entitled to credit of having discovered oil several years earlier but the government took advantage of the wihtdrawal orders of 1909 and the establishment of Naval Reserve No. 1 to claim the land and eject the company from possession.

1920—**Huntington Beach,** first year 38,-116 bbls.; peak 1923, 34,355,642 bbls.; 1933, 13,091,926 bbls.; total to Dec. 31, 1933, 202,556,445 bbls. Discoverer, Standard Oil Co., Huntington A-1, 2381 ft., 70 bbls. 14 gravity.

1919—**Richfield,** first year 965,408 bbls.; peak 1922, 8,314,528 bbls.; 1933, 1,080,247 bbls.; total to Dec. 31, 1933, 70,403,673 bbls. Discoverer, Union Oil Co.

1921—**Long Beach,** first year 75,588 bbls.; peak 1923, 68,810,361 bbls.; 1933, 24,798,242 bbls.; total to Dec. 31, 1933, 502,178,102 bbls. Discoverer Shell Oil Co., Alamitos No. 1, 3114 ft., 483 bbls. 21.8 gravity.

1921—**Santa Fe Springs,** first year 208,-216 bbls.; peak 1923, 79,781,275 bbls.; 1933, 18,271,807 bbls.; total to Dec. 31, 1933, 370,897,210 bbls. Discoverer, Union Oil Co., Bell No. 1, 3788 ft., 2588 bbls., 34 gravity.

1922—**Torrance,** first year 190,785 bbls.; peak 1924, 17,526,123 bbls.; 1933, 2,362,-579 bbls.; total to Dec. 31, 1933, 75,188,-579 bbls. Discoverer, C.C.M.O. Co.

1923—**Dominguez,** first year 157,698 bbls.; peak 1925, 13,328,817 bbls.; 1933, 6,626,605 bbls.; total to Dec. 31, 1933, 63,188,447 bbls. Discoverer, Union Oil Co.

1923—**Wheeler Ridge,** first year 128,674 bbls.; peak 1927, 374,734 bbls.; 1933, 168,-918 bbls.; total to Dec. 31, 1933, 2,910,498 bbls. Disoverer, Standard Oil Co.

1924—**Rosecrans,** first year 611,432 bbls.; peak 1925, 7,263,466 bbls.; 1933, 1,-080,247 bbls.; total to Dec. 31, 1933, 28,-337,251 bbls. Discoverer, Union Oil Co.

1924—**Inglewood,** first year 10,445 bbls.; peak 1925, 18,348,395 bbls.; 1933, 4,059,973 bbls.; total to Dec. 31, 1933, 88,679,063 bbls.

1925—**Newport,** first year 32,661 bbls.; peak 1926, 32,973 bbls.; 1933, none; total to Dec. 31, 1933, 129,019 bbls. Discoverer, Newport Oil & Refining Co.

1926—**Mt. Poso,** first year 46,225 bbls.; peak 1930, 3,883,924 bbls.; 1933, 3,050,826 bbls.; total to Dec. 31, 1933, 74,818,498 bbls. Discoverer, Shell Oil Co.

1926—**Seal Beach,** first year 857,107 bbls.; peak 1927, 16,424,929 bbls.; 1933, 3,991,901 bbls.; total to Dec. 31, 1933, 65,-290,013 bbls. Discoverer, Continental (Marland) Oil Co.

1927—**Round Mountain,** first year 8,700

bbls.; peak 1930, 1,194,832 bbls.; 1933, 1,118,913 bbls.; total to Dec. 31, 1933, 3,764,874 bbls. Discoverer, L. S. Barnes (Elbe Oil, Land & Development C.).

1927—**Potrero**, first year 571 bbls.; peak 1930, 638,533 bbls.; 1933, 141,791 bbls.; total to Dec. 31, 1933, 1,765,225 bbls. Discoverer, Associated Oil Co.

1927—**Elwood**, first year 86,840 bbls.; peak 1930, 14,606,007 bbls.; 1933, 4,918,488 bbls.; total to Dec. 31, 1933, 45,853,988 bbls. Discoverers, Barnsdall & Rio Grande. Goleta area was discovered by E. J. Miley, abandoned in 1930, and production is merged with Elwood.

1927—**Rincon**, first year 5923 bbls.; peak 1929, 1,192,237 bbls.; 1933, 680,471 bbls.; total to Dec. 31, 1933, 5,302,927 bbls. Discoverer, Pan American Petroleum Corp. (now Richfield).

1928—**Fruitvale**, first year 133,433 bbls.; peak 1933, 1,672,805 bbls.; total to Dec. 31, 1933, 5,772,593 bbls. Discoverer, Western Gulf Oil Co.

1928—**Kettleman Hills**, first year, 199,699 bbls.; peak 1932, 21,959,609 bbls.; 1933, 2,624,020 bbls.; total to Dec. 31, 1933, 69,489,295 bbls. Discoverer, Milham Exploration Co.

1928—**Lawndale**, first year 15,686 bbls.; peak 1929, 392,533 bbls.; 1933, 79,460 bbls.; total to Dec. 31, 1933, 850,171 bbls. Discoverer, Smith Development Co.

1929—**Playa del Rey (Venice)**, first year 25,121 bbls.; peak 1931, 9,759,981 bbls.; 1933, 4,059,240 bbls.; total to Dec. 31, 1933, 24,464,286 bbls. Discoverer, Ohio Oil Co.

1931—**San Miguelito**, first year 24,249 bbls.; peak 1933, 390,559 bbls.; total to Dec. 31, 1933, 667,055 bbls. Discoverer, Continental Oil Co.

1929—**El Capitan**, first year 2795 bbls.; peak 1931, 53,183 bbls.; 1933, 24,621 bbls.; total to Dec. 31, 1933, 108,986 bbls. Discoverer, General Petroleum Corp.

1929—**Santa Barbara Mesa**, first year 10,868 bbls.; peak 1933, 276,496 bbls.; total to Dec. 31, 1933, 525,922 bbls. Discoverer was Olympic Refining Co., but its wells proved non-commercial. Wm. Rhoads (Valemont Oil Co.) found commercial oil at a later period.

1933—**Mountain View**, first year 233,341 bbls. Production for 1934 will far exceed this amount. Discoverer, Hogan Petroleum Corp.

1934—**Edison**, discovered by A. T. Jergins interests.

Besides the above fields, there exist five small wells on the Sargent Ranch between Watsonville and Gilroy which produce about 60 bbls. per day and have continued this output for many years. They are the only actual producing wells in Santa Clara county at the present time. Down to Dec. 31, 1933, the total yield of this area is estimated at 786,283 bbls.

Moody Gulch, Santa Clara county, was discovered in 1878. The following year the late W. E. (Uncle Billy) Youle drilled the first (for a time) commercial well. It was not long, however, before all the wells ran dry. Other wells were drilled from time to time and an unknown quantity of oil has been produced. At present the wells are all idle but a San Francisco company is reported to be drilling a new test. Miscellaneous production, such as Moody Gulch, Half Moon Bay and other small areas, now abandoned for the most part, are estimated to have produced about 560,000 bbls. down to Dec. 31, 1933.

North American Drills

North American Oil Consolidated has entered the Goleta area, Santa Barbara county, and will drill a test within three quarters of a mile of the townsite of Goleta. North American has until now confined its operations to the San Joaquin Valley, and mostly to Midway.

Scott Bros. Take Contract

Scott Bros. Drilling Co. has taken the contract to drill the Home Corp.'s new test well, sec. 16, 26-27, eight miles east of McFarland, Kern county, where work will be started shortly. Ray D. Robinson of Los Angeles is superintendent for Home Corp.

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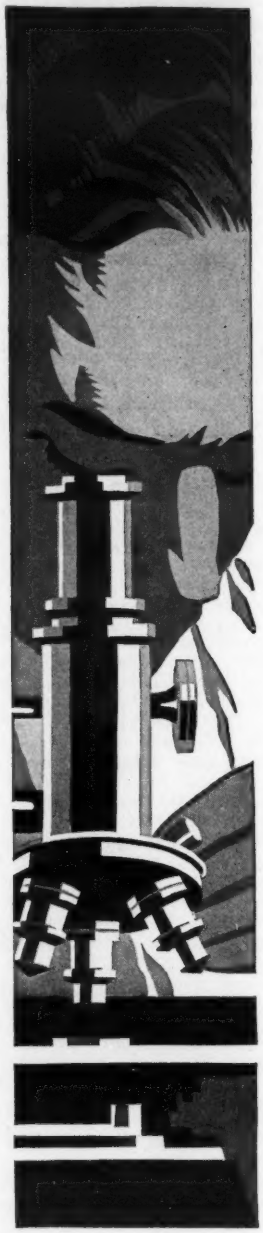

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(Continued from Page 16)

Central Committee's adoption of a balanced method of allocation for September, 1934, which is essentially a minimum well allotment plus a straight percentage of the remaining modified potential.

Ideas on the proper length of time for a potential test vary all the way from one hour to one month, depending upon the locality and type of operators, and ideas regarding the conditions of the test vary just as widely. However, the definition that potential is the quantity of oil which a well is capable of producing and supplying to the market at a sustained rate during an entire calendar month without physical damage to or economic waste from the well and pool has prevailed in California from the very beginning of curtailment and as such is considered to be the true potential with which other potentials are compared and to which they may be corrected.

Normal and Abnormal Potentials

There are a great many wells in the state that for considerable periods of time produce steadily at their true potential rate. Occasionally these wells are stepped-up for a short demonstrative test of their proration potential. Many operators as well as the Oil Umpire have observed and plotted the comparative potentials obtained by steady production and by "squirt" tests as they are frequently called. Figure I is a chart showing numerous normal potentials plotted against the abnormal potentials resulting from tests. The variable conditions during tests are such that the "shotgun pattern" results but the trend of abnormality is clearly indicated and is delineated by the curve as shown. Figure II represents a transposition of this curve to a chart showing the average percentage of abnormality possible with wells of varying true potential.

It is evident of course that a 30 B/D well which can in some manner demonstrate a proration potential of 40 B/D or an increase of 33.3% is not on a comparable basis with a 2,000 B/D well that has a "squirt" potential of 3,900 B/D or an increase of 95%, and greater still is the disparity between the small well that carries no abnormal potential and the big well that has demonstrated an abnormal potential more than twice its normal rate of production. In the above illustration, if the allotment was 40% of the proration potential, the big well would receive 1,560 B/D or 78% of its true potential while the small well would be allotted 16 B/D or only 53% of its true potential.

Observations of this nature by many small well producers resulted in the trend toward the graduated method of allocation and the progressively heavier curtailment of larger wells. Because of the numerous difficulties attending lengthy flow tests the correction of potential by an allocation formula was undertaken rather than the rigorous determination of true potentials. As and when entirely true potentials become the principal factor of allocation a trend toward modification of the graduated method of allocation may be expected.

Maintenance of Potential by Curtailment

In the routine work of estimating potentials for proration purposes it was early observed that decline of potential was a function of the amount of oil produced or the depletion incurred. That is to say, if a well declines from a potential of 1,000 B/D to a potential of 500 B/D while producing 50,000 barrels of oil, its rate of decline may be said to be 50% per 50,000 barrels of production, which is something vastly different from and more descriptive than a statement that the well declined 50% in one year. In fact the time decline rate is of little use in estimating the potential of curtailed wells because it is of significance only when applied to wells of full production.

It has been observed and supported by ample evidence that the volume decline rate varies inversely with the degree of curtailment. In other words, as the production of a well not subject to drainage is restricted, so will its rate of volume decline diminish.

The actual effect of the potential sustaining influence of curtailment is illustrated by Figure III which is typical of the wells and pools that after long curtailment have true potentials considerably higher than would have prevailed if the same amount of oil had been produced at the normal rate. A little thought will show that this effect is perfectly natural and to be expected because the complete shutting in of a pool results in a slight to very considerable build up of potential due to equalization of drainage gradients and fluid levels, partial resaturation and repressuring, and levelling of the water table. Consequently if potential increases with complete curtailment any approach to cessation of production should and does have the effect of correspondingly sustaining the potential production.

Increasing Recovery by Curtailment

If potential is so readily maintained by varying degrees of restriction it is only natural to expect that ultimate recovery should be increased to some degree, otherwise curtailment would result in exhaustion of a field sooner than without curtailment. The exhaustion of a pool can of course be accelerated by methods which ostensibly show curtailment but which actually result in a factor greater than normal rate of depletion.

A typical illustration of the effect of curtailment in increasing not only the potential but also the indicated remaining recoverable oil is found in the Torrance Field as depicted by Figure IV. In this case the actual sustained production of the field, which is still under a definite degree of curtailment, is greater than the potential indicated after production of the known amount of oil. More important still is the indicated increase of nearly three million barrels in the ultimate recovery of the field before its eventual commercial exhaustion.

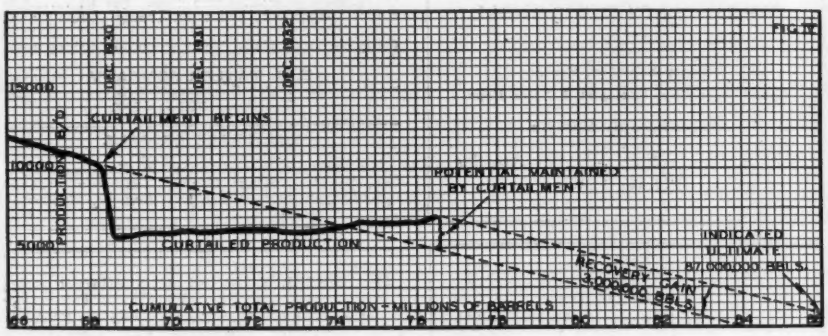

Figure IV

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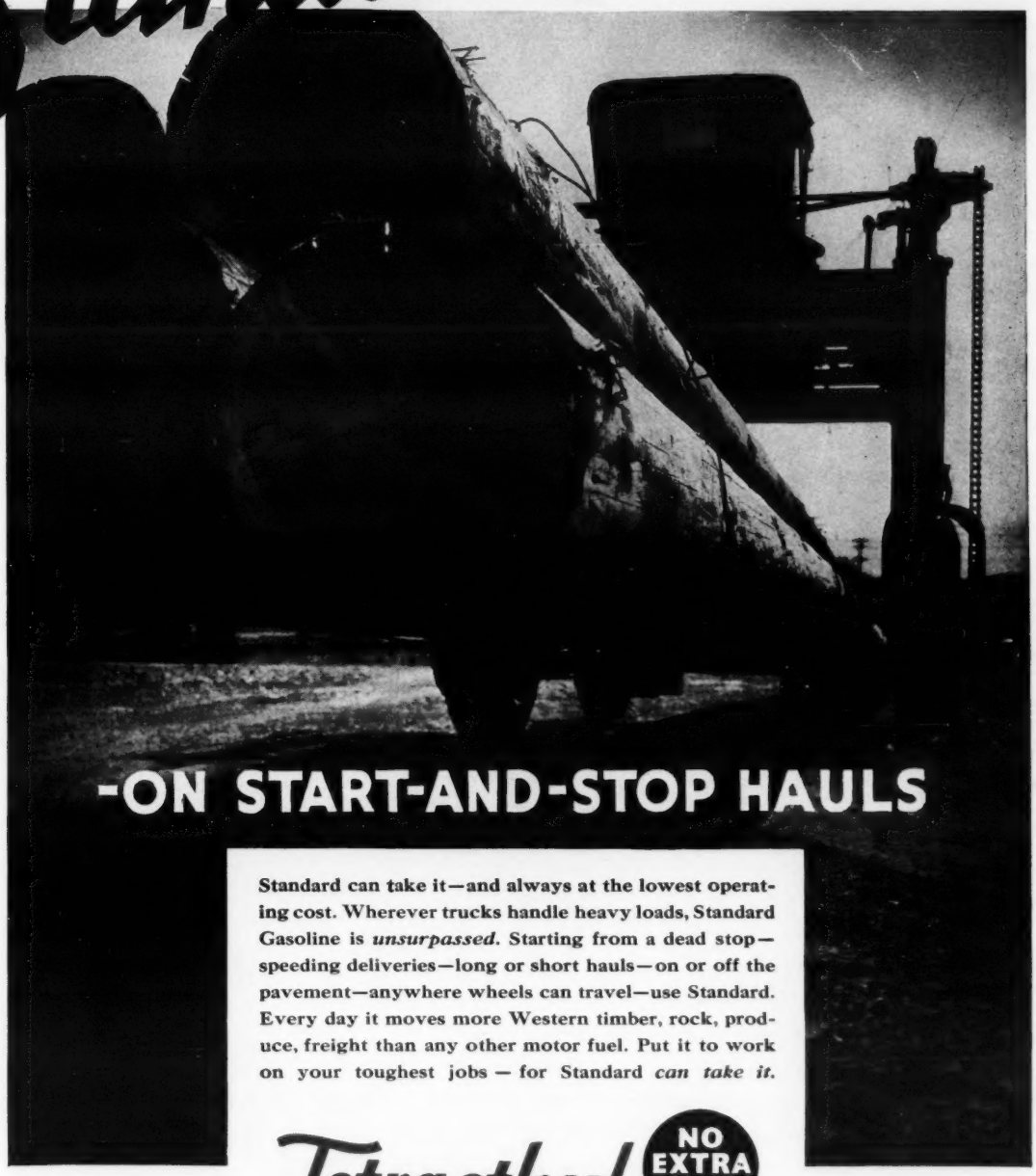

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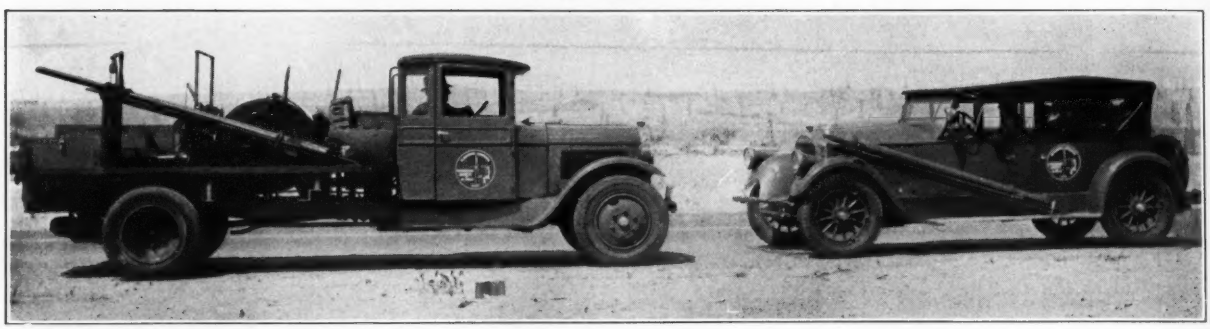

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